User Manual

Models Included: SmartOneA, SmartOneB, SmartOneB-LP
Revision: 1.7

Globalstar
Be Heard.

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Addendum

I. A new version, **SmartOne LP**, is available. This version can be powered by line power or batteries. It can be supplied line power with the External Inputs Cable or the Serial Input Cable.

Specifications:
A. Input Voltage- The SmartOne LP will operate on 10 to 48 Volts DC.

B. Switching- If batteries are installed, the unit will automatically switch to battery power if line power input is lost.

C. Connection Method-

1. When using the Serial Input Cable, connect the voltage supply positive(+) to the VIOLET wire through a 1 Ampere Fuse. The fuse should be placed within 1 foot (30cm) of the voltage source. Connect the negative(-) source to the GRAY wire. Always use crimp connectors or solder the wires and cover the connection with shrink tubing.

II. A new accessory, the **Serial Input Cable**, is available. This cable simplifies the sending of serial data (see page 66). In addition, it supplies access to the Dry Contact Inputs and the Line Power inputs.

SMARTONE **Basics**

Overview

The **SMART**ONE is designed to track the position of Trailers, Cargo Containers, Heavy Construction Equipment, Generators, Boats/Barges and any other mobile assets. The **SMART**ONE also has 2 inputs to manage run time of engines and/or other alarm inputs.

The SM**ART**ONE processes GPS satellite signals to obtain its position in terms of longitude and latitude and transmits this information over Globalstar's Simplex Satellite Network. In addition to position information, the **SMART**ONE transmits other message types that include battery status, input alarm status and diagnostic information. The **SMART**ONE is configured using a computer and connection cable to communicate these messages at certain times and/or under certain conditions.

Modes of Operation

The **SMART**ONE can be configured to operate in three different Modes: Standard Messaging Mode, Reduced Messaging Mode and Theft Recovery Mode.

Standard Messaging

In Standard Messaging Mode, the **SMART**ONE reports its position at regular time intervals that are programmed during the configuration process. Standard Messaging Mode can also be configured to utilize the **SMART**ONE's internal vibration sensor. If enabled, the SMARTONE will transmit its position at independently configured regular time intervals when the device is In Motion.

Location messages can be programmed to be constant (Message Interval) or the device may be configured to use up to 12 different delays in sequence (Message-Time(s) of Day). Message Interval can be programmed in 1 minute intervals from 35 minutes up to 45 days.

> *Example of Message Interval: The **SMART**ONE is configured to report once every 24 hours when not in motion and every 2 hours when In Motion. If the **SMART**ONE went into motion at any time of day the Message Interval while In Motion would be every 2 hours beginning when the **SMART**ONE started moving.*

> *Example of Message-Time(s) of Day: The **SMART**ONE is configured with a message time of day of 9:00am, a second message time of day of 12:00 noon, a third message time of day of 8:00pm and once per hour when In Motion. The **SMART**ONE would transmit 3 messages a day at the same configured times every day. If the **SMART**ONE went In Motion it would transmit its location message every hour.*

Usage Example: A Company is required to report the GPS locations of their hazardous chemical containers twice a day. Based on this requirement the Company has 2 options: set a message interval of every 12 hours, the 12 hour internal begins when the device is powered up or configure message times of day 12:00 noon and 12:00 midnight.

Reduced Messaging

Reduced Messaging Mode reduces the cost associated with transmitting messages over Globalstar's network by sending messages at a minimal message interval when the asset is in a defined area and transmitting at a higher message interval when the asset is changing locations. These message intervals are set as part of the configuration process based on the concept that repeated reporting information of the same location when an asset has not moved from its defined area is redundant and doesn't provide addition usable information about its current location.

By comparing current and prior position information, the **SMART**ONE determines if its location is changing. The definable area in which the device should remain in Reduced Messaging Mode is called the Change of Location Area and it is a square. When the **SMART**ONE goes outside of the square, its location is considered to be changing or relocating.

*Usage Example: A fleet operator owns 1,000 trailers. When the trailer(s) are sitting at a depot they want a location message once a day. They also want a message notification within 1 hour when a trailer has left a depot. Lastly, they want a location message every 3 hours when a trailer is moving between depots. Based on this requirement, the fleet operator will need to set the Change of Location Area (size of the depots where the trailers will visit), the message interval while the trailers are inside the Change of Location Area (1 per day), the interval at which the **SMART**ONE will check its location while in a State of Vibration and inside the Change of Location Area(1 per hour), set the number of messages when the trailer leaves the Change of Location Area (1 Change of Location Area Alert Message) and the message interval while the trailers are in transit between depots (every 3 hours).*

Theft Recovery

When the **SMART**ONE is configured to operate in the Theft Recovery Mode, it differentiates between authorized and unauthorized movement of an asset. While the power to the **SMART**ONE is turned off, all movement of the asset is considered authorized. When power is turned on, the **SMART**ONE obtains a position from GPS satellite signals. The position is used to set the center of the defined Change of Location Area in Theft Recovery Mode. While in the Change of Location Area, the **SMART**ONE obtains position fixes at an interval set during configuration. As long as the **SMART**ONE remains within the Change of Location Area all movement is considered to be authorized.

Once the **SMART**ONE's position is outside of the Change of Location Area, it alerts the **SMART**ONE to an unauthorized movement and immediately sends a location message (Change of Location Alert Message). The **SMART**ONE then continues to send location messages at a message interval set during the configuration process until the power is turned off or the battery is dead.

*Usage Example: A construction company is working on a job site for 1 year and wants to make sure that the generators and other heavy equipment on site are not stolen. The company wants to check the location of their equipment 12 times a day, every 2 hours, to confirm the asset hasn't been stolen but only wants a transmitted location message once per day. Based on this requirement, the construction company will need to set the Change of Location Area (size of the job site), the message interval while inside the Change of Location Area (1 per day), the interval at which the **SMART**ONE will check its location while in a State of Vibration and within the Change of Location Area (every 2 hours) and the message interval if the asset is outside the Change of Location Area (stolen).*

Inputs

The **SMART**ONE has a 20 pin connector that provides ground, two dry contact inputs and a power switch input.

The **SMART**ONE allows sending Input Status Changed Messages for both Input 1 and Input 2. The Inputs must be asserted for at least 5 seconds in order to be acknowledged.

*Usage Example: A construction company needs to document, per their contract with the City, when they begin their work day and when they end their work day. Based on this requirement, the **SMART**ONE would be connected to the ignition switch and configured to send a transmission with location when the input changes state.*

The **SMART**ONE also allows the user to define the Message Interval while the Inputs are in an Undesired State, either Opened or Closed.

*Usage Example: A company has remote containers at job sites and would like to know if a door is ajar. If a door is left ajar the company would like a notification every 2 hours. Based on this requirement, the **SMART**ONE would be connected to an open door sensor with the Undesired Input State Message enabled and set as Opened with a Message Interval of 2 hours.*

Note: The SMARTONE uses a 5 minute "hysteresis" window to prevent sending false alarms. This means that only one status change message can be sent during any 5 minute time window. Any subsequent status changes will be detected but not reported. Multiple status changes during any 5 minute window will result in the transmission of incorrect trigger bits. Refer to page 53 for "Input Status Changed Message".

The **SMART**ONE has the ability to send an Accumulate/Count Message at a regular configurable interval and/or based on configurable multiples of accumulated hours and/or number of counted events or hours of vibration.

Usage Example 1: A construction company needs weekly engine run times for their heavy equipment to manage their maintenance scheduling. Based on this requirement, the company would schedule a weekly Accumulate/Count Message.

Usage Example 2: A construction company wants to insure that no equipment is ever operated beyond 400 hours without maintenance. Based on this requirement, the company would schedule an Accumulate/Count Message for every 400 hours of use.

The **SMART**ONE has the ability to send both Status Change and Undesired State messages based on vibration.

Serial Commands

The SMARTONE uses the I/O port for unit configuration as well as interface to remote passive and smart sensors. Two commands are provided in the unit interface to support smart sensors. External sensors or instruments that can format and communicate to the SMARTONE can send user data through the SMARTONE by using these two commands.

The SMARTONE connects to smart sensors via the SMARTONE Serial Cable.

Spot offers 2 accessory cables for the **SMART**ONE, the USB Configuration Cable and the Serial Cable. See Appendix E: Accessories.

Satellite Communications

The **SMART**ONE communicates with both the GPS satellite Network and the Globalstar Simplex Satellite Network. All GPS locations are pulled from the GPS network and all transmissions are sent via the Globalstar Simplex Satellite Network.

The **SMART**ONE has the unique ability to check its GPS Coordinates at a programmable rate while it is inside of the Change of Location Area without actually sending a message over the Globalstar Simplex Satellite Network.

For a Location Message, the **SMART**ONE will wake up at a scheduled interval or time of day and begins to acquire a GPS fix. Once it receives its GPS fix, it will transmit the location to the Globalstar Simplex Satellite Network.

Globalstar Simplex Satellite Network

The network consists of 40+ Low Earth Orbiting (LEO) satellites that are constantly orbiting the earth and complete their orbits in less than 2 hours. Because of this, the **SMART**ONE will be in contact with at least one of the satellites during each scheduled transmission. In LEO communication networks the satellites are constantly changing their positions in the sky relative to the transmitter on earth. This minimized the shading effects seen in geostationary satellite systems

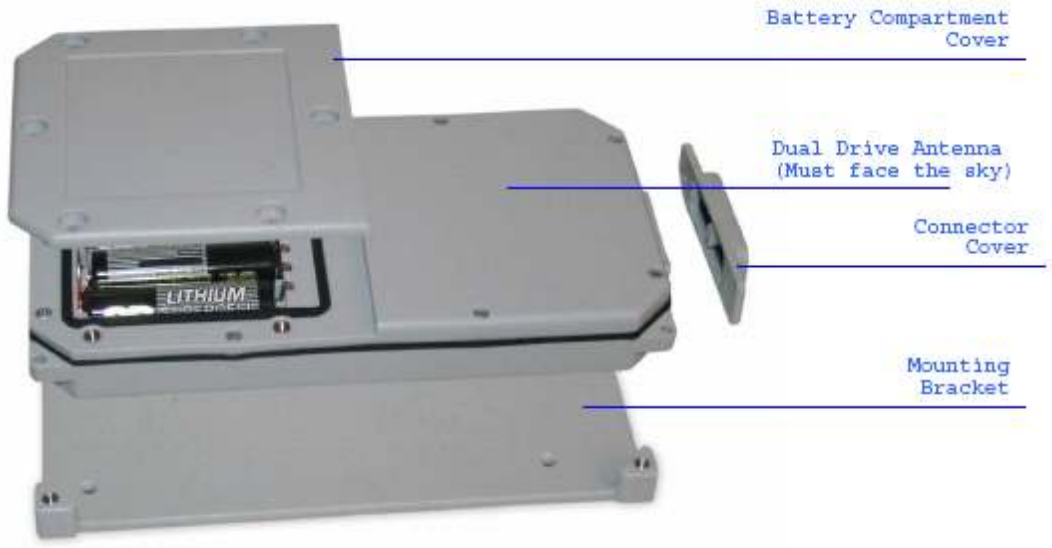
where the mobile device must be pointed toward a specific direction in the sky. Geostationary satellites also orbit at a much higher altitude and move along the equator.

Messages are transmitted from the **SMART**ONE via the Globalstar Simplex Satellite Network using an uplink-only connection (one-way data transmission) and received by a Globalstar Simplex Ground Station. The messages are then sent via an HTTP or FTP server to the internet and received by the VAR or end customer's back office application and converted into actionable data.

The **SMART**ONE will send each message 3 times to insure that the message has been received by the Globalstar Satellite Constellation. Once Globalstar receives the message, any remaining duplicate messages are ignored and discarded (VAR or end user account is only charged for 1 transmission).

Getting Started

The SMARTONE Device



Installing Batteries

The **SMART**ONE is powered by four 1.5v Lithium 'AA' batteries. The battery compartment is accessible from the top of the device by removing the six slotted screws. Remove the water-tight cover and insert the batteries as indicated.

**When the batteries are removed and replaced the device will retain its configuration.*

Battery Placement

Turning On and Off

To turn the device 'On' or 'Off', remove the connector cover from the end of the device. Then invert and replace the connector cover so that the word 'Off' or 'On', whichever is desired is visible.

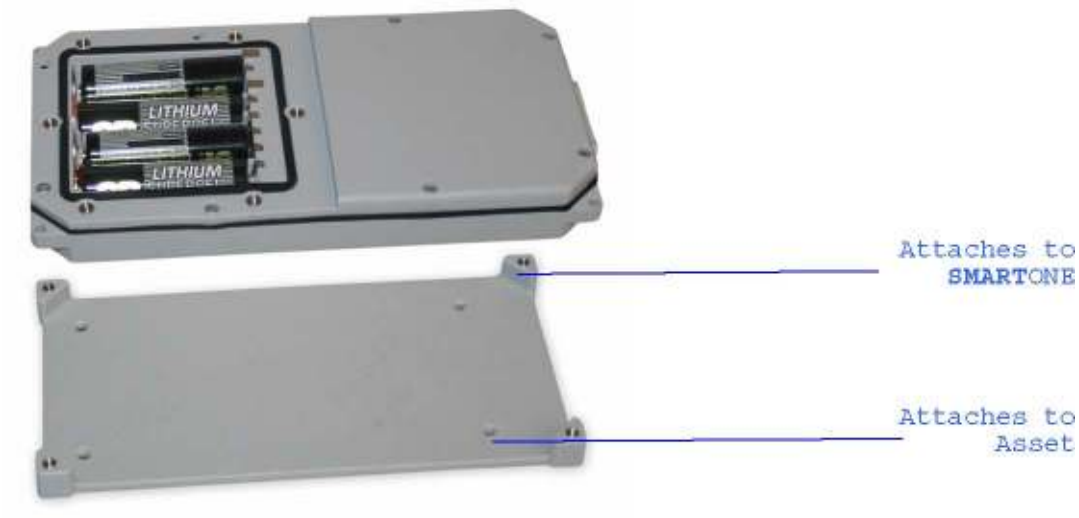
*See Appendix F – Battery Installation Guide for further information on how the connector cover should engage with the **SMART**ONE.

Indicates Device is 'ON'

Indicates Device is 'OFF'

Mounting

The **SMART**ONE is designed to be mounted to an asset using double-sided adhesive tape and/or the included mounting bracket. The mounting bracket has four screws that attach to the asset and allows the **SMART**ONE to be mounted so the antenna can face the sky whether mounted internally or externally. This enables the antenna to have a direct view of the sky with mounting flexibility. The **SMART**ONE attaches to the mounting bracket using four Phillips-head screws.



Programming Overview

The **SMART**ONE comes ready to use with a factory configuration loaded in the device. The factory configuration, Standard Messaging without Motion and Interval Messaging of 12 hours, may be changed using the **SMART**ONE Configuration Software, the USB Configuration Cable and a PC.

Inputs

The **SMART**ONE has two inputs that can be accessed by using the **SMART**ONE Input Cable, which is sold as an accessory to the device.

Installation of Configuration Software

The **SMART**ONE Configuration Software can be downloaded from the Spot website at http://var.globalstar.com. Log-in to your VAR account using your username and password. The Configuration Software is located in the software downloads section and is supported by Windows 7, Windows Vista, Windows XP Service Pack 2, Windows 2000 and Windows 98.

Connecting Devices

The **SMART**ONE, with batteries installed and battery cover screwed down, connects to a PC using a USB Configuration Cable. The **SMART**ONE Configuration Software may be used without being connected to devices to prepare configurations, but must be connected to a device using the USB Configuration Cable to Program. Once the Program button has been depressed the Configuration Cable should not be disconnected, if already connected, from the device and/or the computer. The USB Configuration Cable plugs into the **SMART**ONE when the connector cover is removed.

SMARTONE Configuration Software

Once installed on a PC, the **SMART**ONE Configuration Software is used to configure **SMART**ONE's. The configuration has a tab-based, context-switched user data entry pane on the top screen of the window and a static status pane on the bottom.

User Data Entry Pane

The user data entry pane contains a context-switched user entry area for displaying and inputting configuration data. The information is organized in pages with page manipulation provided through tabs along the top of the pane. Selecting a tab will change the context of the upper pane. The tabs are named to group similar functions on the same page. The tabs will change according to the operation Mode selected. The Back and Next buttons allow the user to move from tab to tab without clicking on the tab name.

Status Pane

The Status Pane contains a table with a list of devices connected to the PC, their ESN(s), firmware version and COMM port assigned to each device as well as the execution buttons for configuring connected **SMART**ONE(s).

ESN Status Display Table

ESN Column - This column displays a list of the Electronic Serial Numbers for **SMART**ONE(s) connected to the PC.

FW Ver Column - This column displays a list of firmware version for the main processor for each **SMART**ONE in the list.

COM Column - This column displays a list of the assigned serial communication ports for each **SMART**ONE.

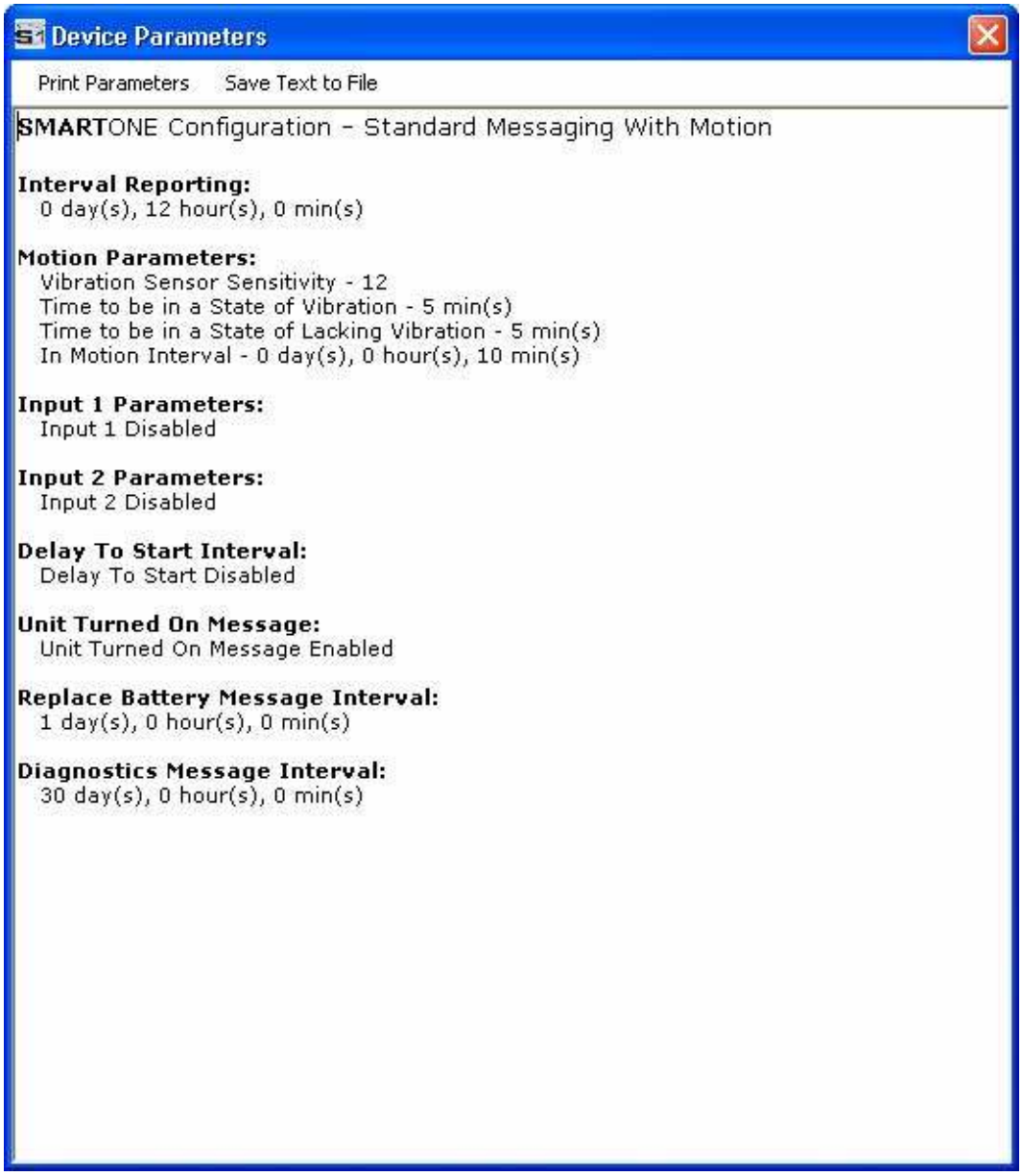
List ESN(s) Button

This button shall cause the Configuration Software to search for any valid devices that are connected to the PC.

A pop up window informs the user that the program is searching for devices connected to the computer while this search is being performed.

View Summary Button

This button causes the Configuration Software to open a separate window, which contains plain text readout of every user configurable parameter that exists for the **SMART**ONE.


Device Parameters
Print Parameters
Save Text to File
SMARTONE Configuration - Standard Messaging With Motion
Interval Reporting:
0 day(s), 12 hour(s), 0 min(s)
Motion Parameters:
Vibration Sensor Sensitivity - 12
Time to be in a State of Vibration - 5 min(s)
Time to be in a State of Lacking Vibration - 5 min(s)
In Motion Interval - 0 day(s), 0 hour(s), 10 min(s)
Input 1 Parameters:
Input 1 Disabled
Input 2 Parameters:
Input 2 Disabled
Delay To Start Interval:
Delay To Start Disabled
Unit Turned On Message:
Unit Turned On Message Enabled
Replace Battery Message Interval:
1 day(s), 0 hour(s), 0 min(s)
Diagnostics Message Interval:
30 day(s), 0 hour(s), 0 min(s)

View Summary Window

The Menu Bar in the View Summary Window allows the user to either print the parameters or save the configuration parameters to a text file. This window remains open while the user manipulates the fields in the User Data Entry Pane tabs and will update as changes are made.

Program Button

The PROGRAM button in the Status Pane is used to send the data in the Configuration Software to the connected **SMART**ONE (s). The **SMART**ONE will be updated with the data from the Configuration Software.

The user is queried to confirm device program before execution of the function.

File Menu in the View Summary Window allows the user to either save the configuration to file or print configuration.

Toolbar

File Menu

New Configuration. This will reset the values for all configurable parameters to default. Standard Messaging without Motion with a transmission every 12 hours is the default Mode of operation.

This selection will open a prompt window asking for confirmation to restore all settings to their default. This will not affect the settings stored inside the connected **SMART**ONE(s). The settings will only reset in the software display, not in any device(s) connected to the PC unless the PROGRAM button is clicked to download configuration to the device.

Open Configuration from File. This opens a window that allows the user to browse for a valid configuration file that has previously been saved. Selecting a file will cause all of the settings contained in the file to be loaded into the software display only, not in any devices connected to the PC. Click the PROGRAM button to download configuration to the device.

Read Configuration from SMARTONE. This will query all of the configurable parameters saved in a device connected to the PC. The values for each configurable parameter in the device will be displayed in the User Data Entry Pane.

Save Configuration. This will open a window that allows the user to browse to a location and save all of the configuration settings to two separate files:

The configuration file. This file is non-editable.
A text file. An ASCII format file that contains each parameter and parameter value in a standard delimited format.

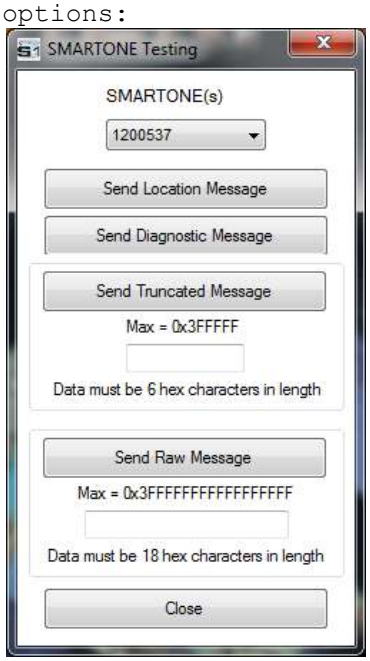
Open Configuration from History. Every time a device is successfully programmed, the configuration will save that occurrence to a text log file. The information stored is the ESN of the device, the local time at which it was programmed and the actual configuration of the device.

When selected, a window opens where the user can sort by ESN or date/time of programming and select a configuration. This loads the selected configuration settings into the User Data Entry Pane, but not into any device(s) connected to the PC.

Exit. This causes the program to close.

Tools Menu

SMARTONE **Testing.** This command opens up a window with the following options:



Send Location Message - causes the **SMART**ONE connected to the COM port to obtain a GPS fix and send a Location Message.

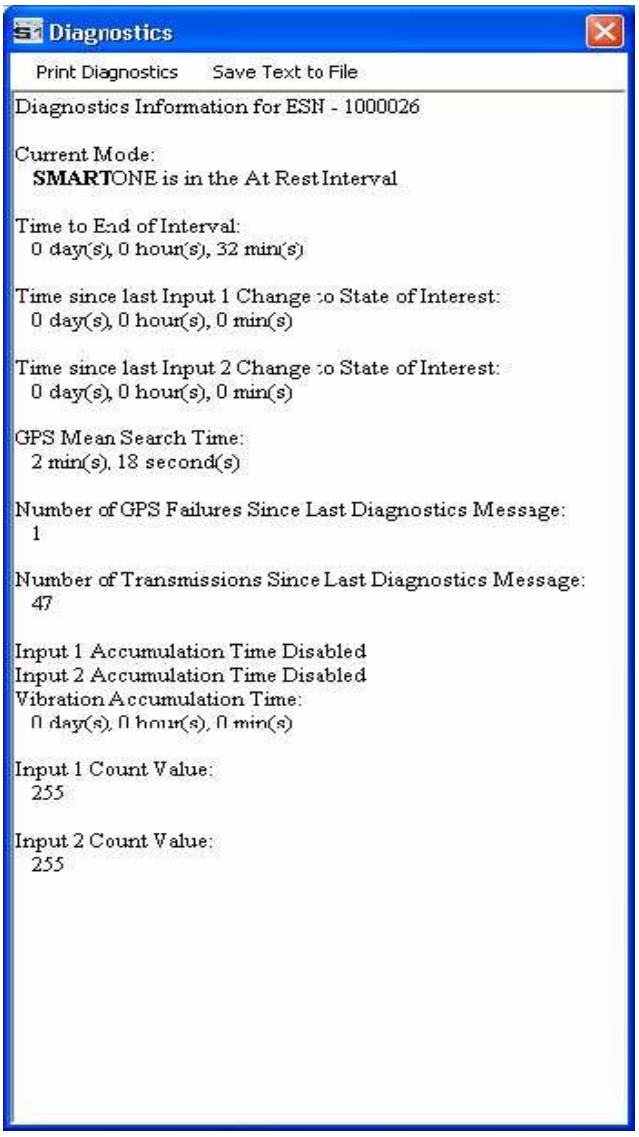
Send Diagnostic Message – causes the SMARTONE connected to send diagnostic information including battery status, GPS average search time, GPS fails and number of transmissions since last diagnostic message.

Send Data w/GPS Message - causes the **SMART**ONE to seek a GPS location, and then send a Truncated **SMART**ONE message (type 1). The hex-character data in the text box below the command will be appended to the GPS data and sent.

Send Data w/o GPS message - causes the **SMART**ONE to send the first 8 bytes of data in the text box above the command as the payload for the Raw Payload Message (type 2). The hex-character data in the text box above the command will be sent instead of the normal **SMART**ONE position data.

Close – causes the pop up window to close.

Read Diagnostic Information from Device. This command line causes the Configuration Software to query the diagnostic information from the **SMART**ONE and display the information in a pop up window in a text format.

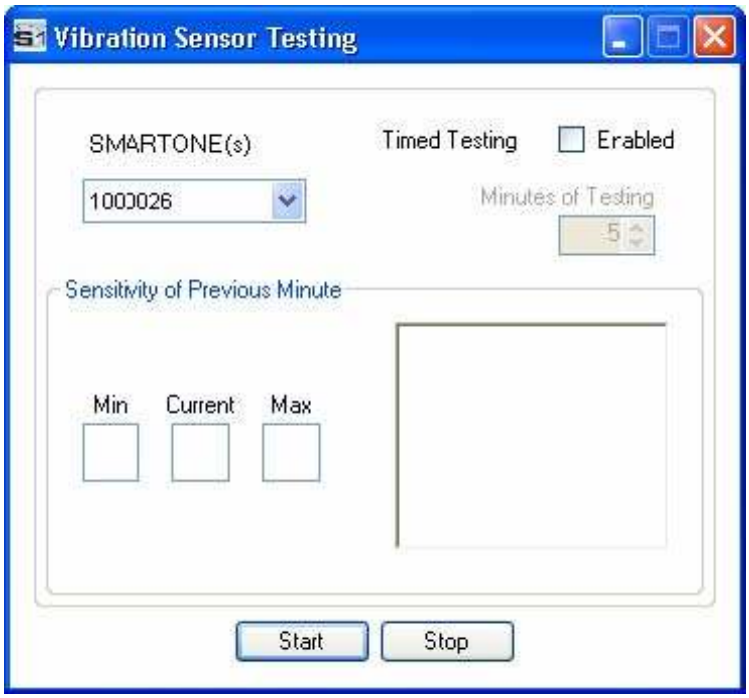

Diagnostics
Print Diagnostics
Save Text to File
Diagnostics Information for ESN - 1000026
Current Mode:
SMARTONE is in the At Rest Interval
Time to End of Interval:
0 day(s), 0 hour(s), 32 min(s)
Time since last Input 1 Change to State of Interest:
0 day(s), 0 hour(s), 0 min(s)
Time since last Input 2 Change to State of Interest:
0 day(s), 0 hour(s), 0 min(s)
GPS Mean Search Time:
2 min(s), 18 second(s)
Number of GPS Failures Since Last Diagnostics Message:
1
Number of Transmissions Since Last Diagnostics Message:
47
Input 1 Accumulation Time Disabled
Input 2 Accumulation Time Disabled
Vibration Accumulation Time:
0 day(s), 0 hour(s), 0 min(s)
Input 1 Count Value:
255
Input 2 Count Value:
255

There are two menu options available in the pop up window:

Print Diagnostic –prints the diagnostic information.

Save Text to File – Opens a window, which allows the user to browse for a location and save the diagnostic information in a text file.

Test Vibration Sensor Button is used to find the minimum, maximum and average vibration sensitivity detected by the sensor. This information helps to determine the appropriate Level of Sensitivity for the vibration sensor. This window will update real time while connected to the **SMART**ONE.



Help Menu

About. This pops up a window with the **SMART**ONE Configuration version number.

Getting Started Tab

The Getting Started Tab allows the user to select the Mode of operation for the **SMART**ONE. The Modes include Standard Messaging with or without motion, Reduced Messaging and Theft Recovery Mode.

Standard Messaging Mode without Motion

The Standard Messaging without Motion Mode is selected for basic tracking functionality on the **SMART**ONE. The **SMART**ONE will automatically report its position at regular time intervals. The messages sent in this Mode are called Location Messages. These messages include the GPS coordinates of the actual location of the **SMART**ONE.

In this Mode, the vibration sensor is OFF.

Standard Messaging Mode with Motion

The Standard Messaging with Motion Mode is selected for basic tracking functionality with motion detection capabilities. The user defines the motion parameters for each application including the Level of Sensitivity of the vibration sensor, Time to be in a State of Vibration and Time to be in a State of Lacking Vibration. The **SMART**ONE can be set to report at a different rate, Message Interval while In Motion, compared to the Location Message Interval.

Reduced Messaging Mode

The Reduced Messaging Mode is ideal for asset management with reduced messaging capability of the **SMART**ONE. The **SMART**ONE creates a Change of Location Area of configurable size around the device. If the **SMART**ONE stays within its Change of Location Area, the number of transmissions will be reduced.

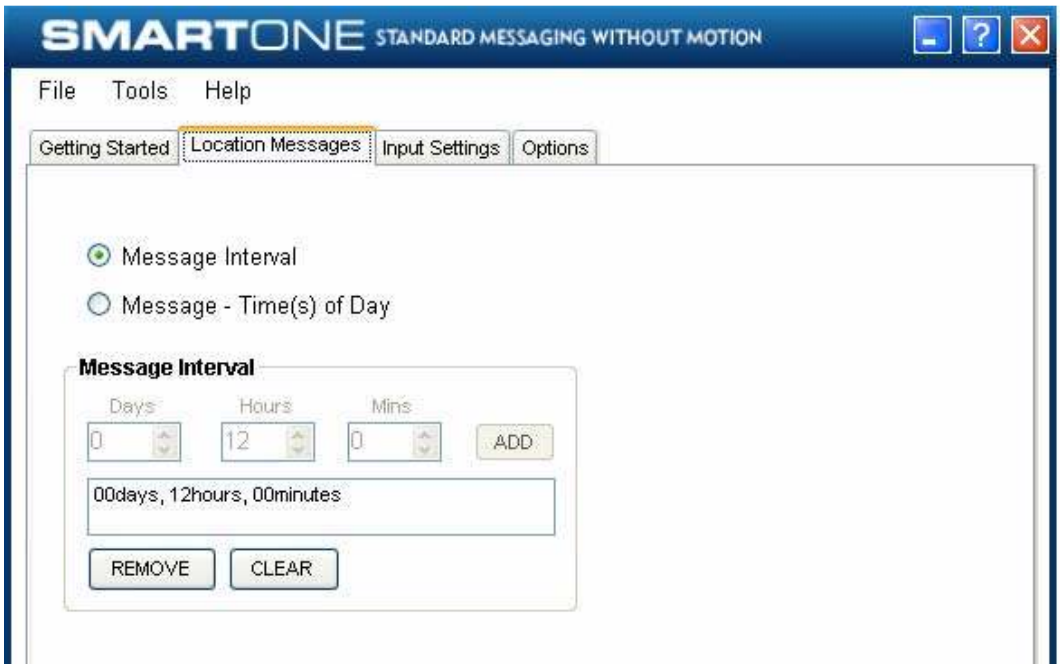
When the **SMART**ONE leaves the Change of Location Area and returned to a State of Lacking Vibration a new Change of Location Area is created around the **SMART**ONE.

Theft Recovery Mode

The Theft Recovery Mode is ideal for assets that are high-risk for theft. In this Mode, the **SMART**ONE creates a Change of Location Area around its location when powered. The size of the Change of Location Area is a configurable parameter equal to the distance the device must move to be considered outside the Change of Location Area. If outside the Change of Location Area, the **SMART**ONE goes into recovery Mode, transmitting frequent messages until the asset is recovered. The message interval in recovery Mode is a configurable parameter; however, the default value is 10 minutes.

Standard Messaging Mode without Motion

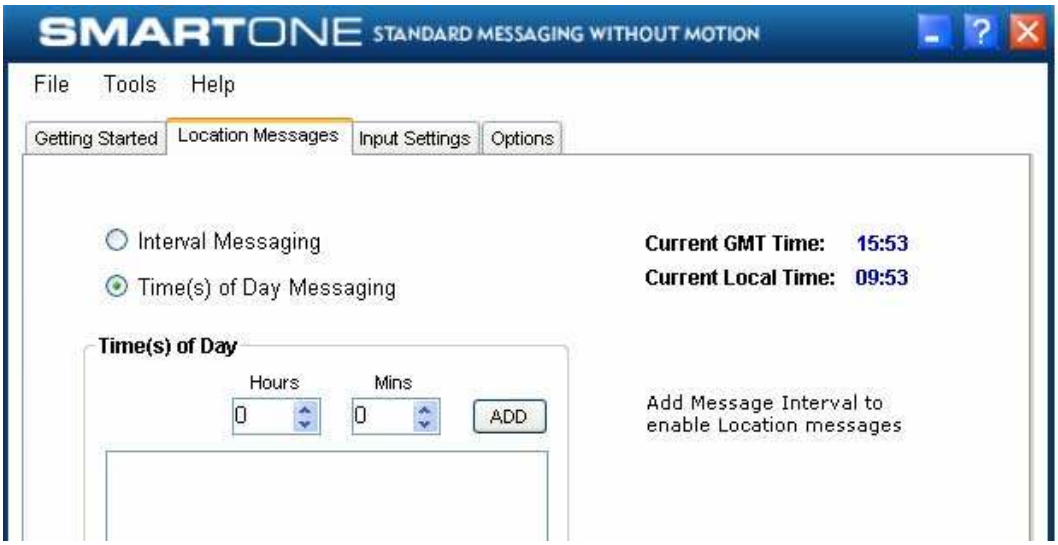
Location Messages Tab



Message Interval. The **SMART**ONE can be configured to report at a specific message interval specified by days, hours and minutes. The **SMART**ONE accepts a single interval only.

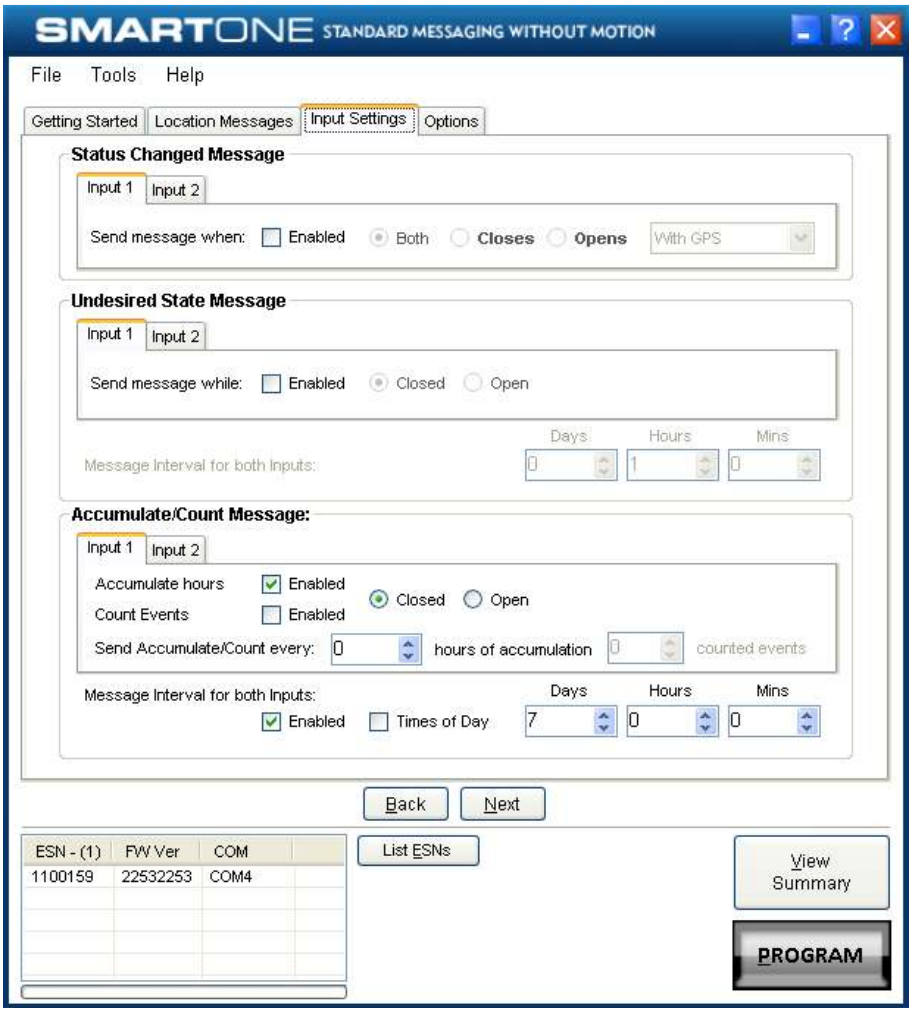
Once the interval has been entered in Days, Hours, and Minutes, click the ADD button to accept the interval and add it to the message interval box.

Message – Time(s) of Day. The **SMART**ONE can be configured to report at specific time(s) of day. The message interval box allows up to 12 times of day to send Location Messages.



The REMOVE button deletes the selected time of day or interval from the message interval box. The CLEAR button deletes all the time of days or interval in the message interval box.

Input Settings Tab

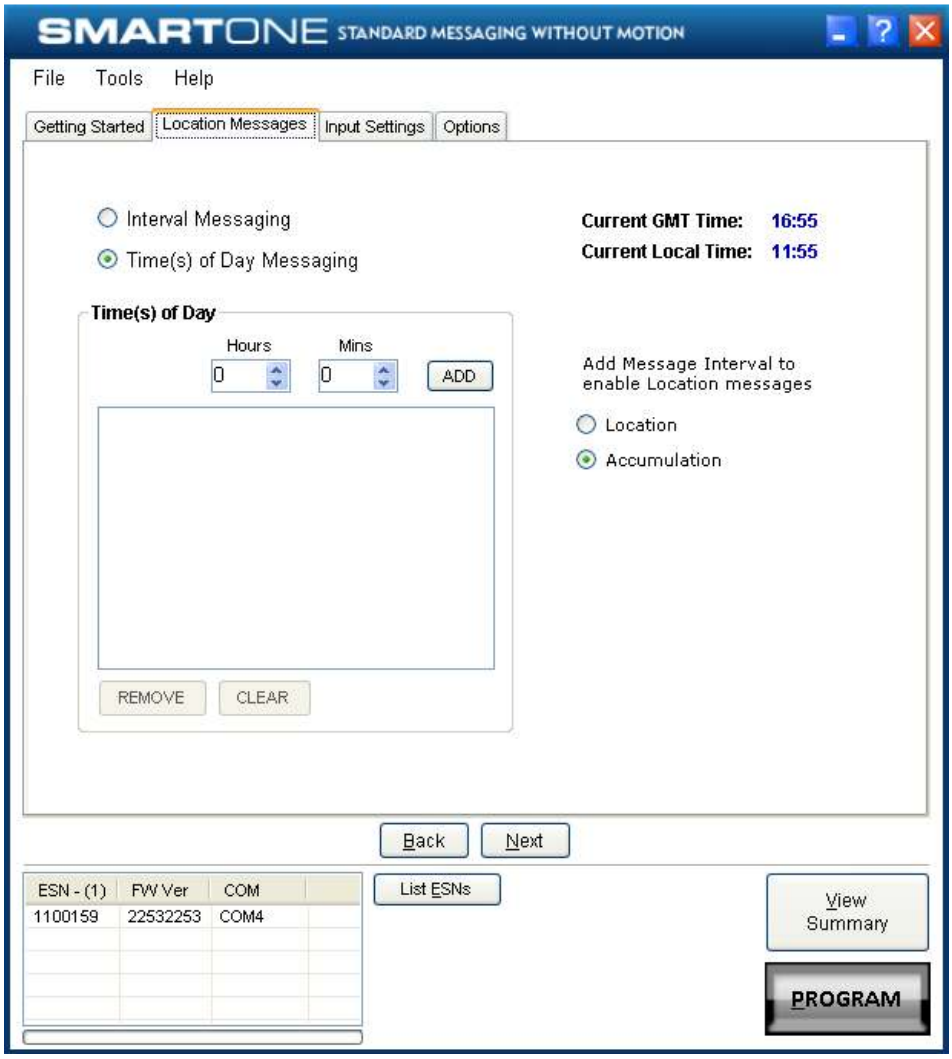


Status Changed Message. The **SMART**ONE has two inputs that can be configured to send a Status Changed Message once the selected input opens, closes, or in both events. The Message sent can or cannot contain the GPS coordinates of the device at the time the status of the input(s) changed.

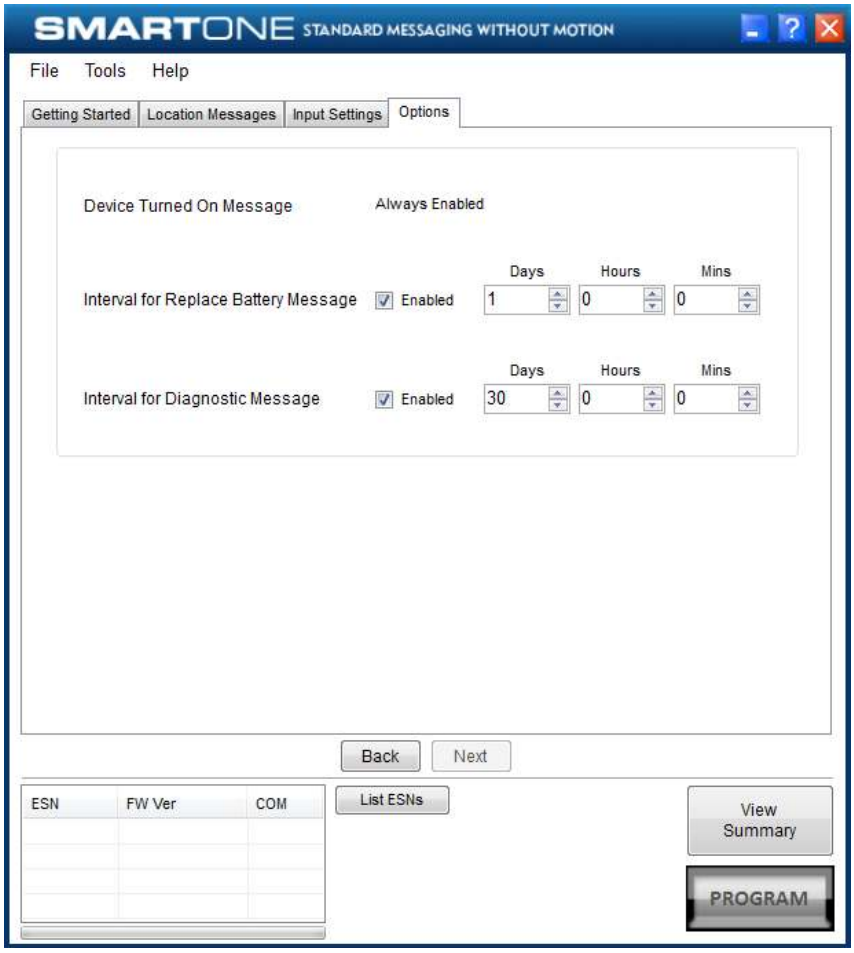
Undesired State Message. The **SMART**ONE can be configured to send messages throughout the time the input is in the desired state, either to opened or closed position. The message interval while the input is active can be configured in Days, Hours, and Minutes. Once the input is de activated, the **SMART**ONE will return to the message interval or time (s) of day for Location Messages.

Accumulate/Count Message: The **SMART**ONE can accumulate hours and events while input 1 or input 2 is enabled. The **SMART**ONE can send an accumulate/count message once the configurable intervals specified in days, hours, and minutes. If Times of Day is selected, user will specify

the times in the Location Message Tab.



Options Tab



Device Turned On Message. The **SMART**ONE is configured to send a Device Turned On Message on Power-up by default.

Interval for Replace Battery Message. The **SMART**ONE can be configured to transmit a Replace Battery message based on a low battery condition. Configuration range extends from 0 to 45 days in steps of a day. The default is 1 day.

The **SMART**ONE will detect low battery conditions while at least 100 more messages can still be transmitted.

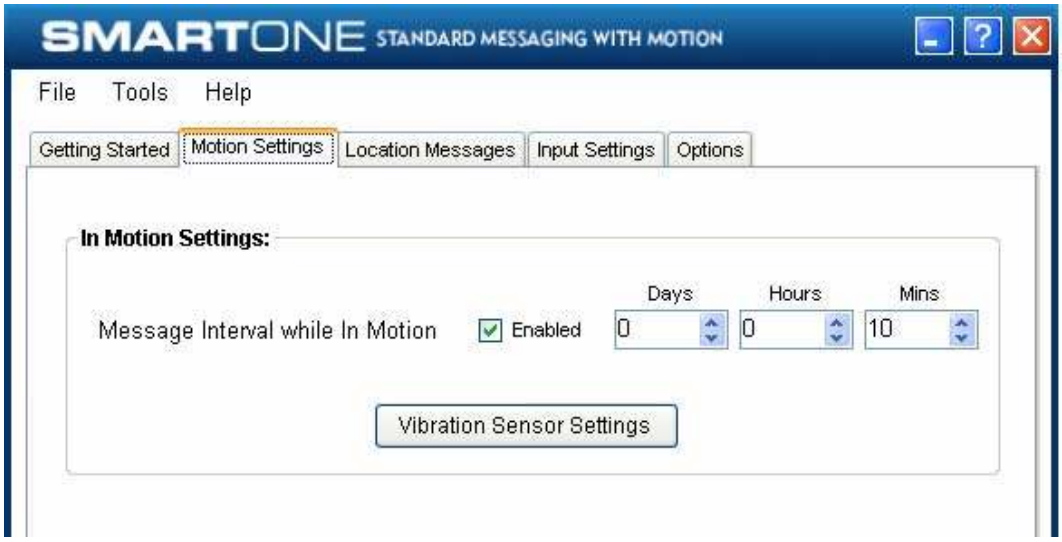
Interval for Diagnostic Message. The **SMART**ONE can send a diagnostic message with information on the diagnostic status of the device. The diagnostic message includes battery status, GPS average search time, GPS fails and number of transmissions since last diagnostic message.

Transmit interval of diagnostic messages with a transmission rate from 1 to 45 days. The default is 30 days.

Standard Messaging Mode with Motion

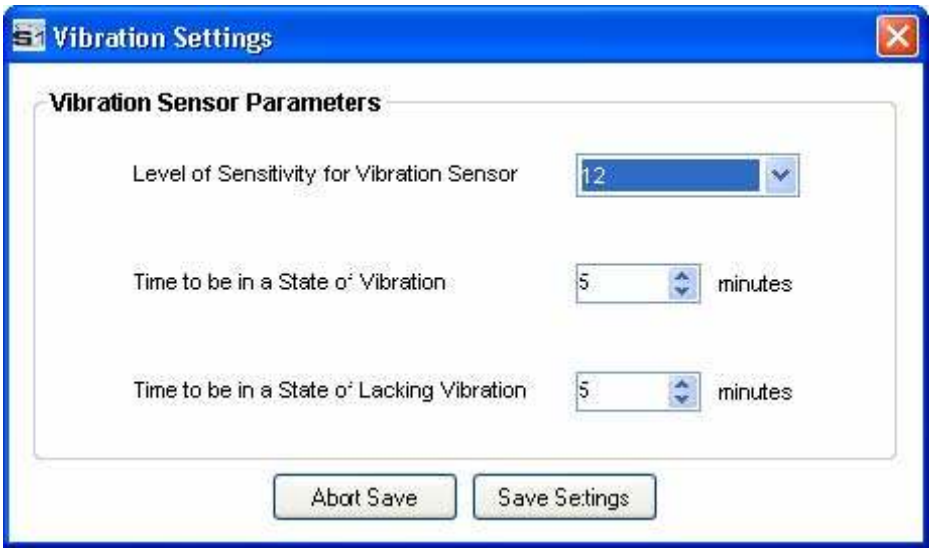
Motion Settings Tab

The Motion Settings Tab of the Configuration Software is used to define the Message Interval while In Motion. This tab also contains the Vibration Sensor Settings, which define how the sensitivity of the Vibration Sensor and how it determines the device is In Motion.



Message Interval while In Motion. This parameter defines the transmission interval of location messages while **SMART**ONE is In Motion with a transmission rate between 5 to 65,000 minutes (45 Days). The default is 10 minutes.

Vibration Sensor Settings Button. This button activates the Vibration Settings window. This window contains settings to define how the vibration sensor determines that the **SMART**ONE is In Motion. These parameters include Level of Sensitivity for Vibration Sensor, Time to be in a State of Vibration and the Time to be in a State of Lacking Vibration.

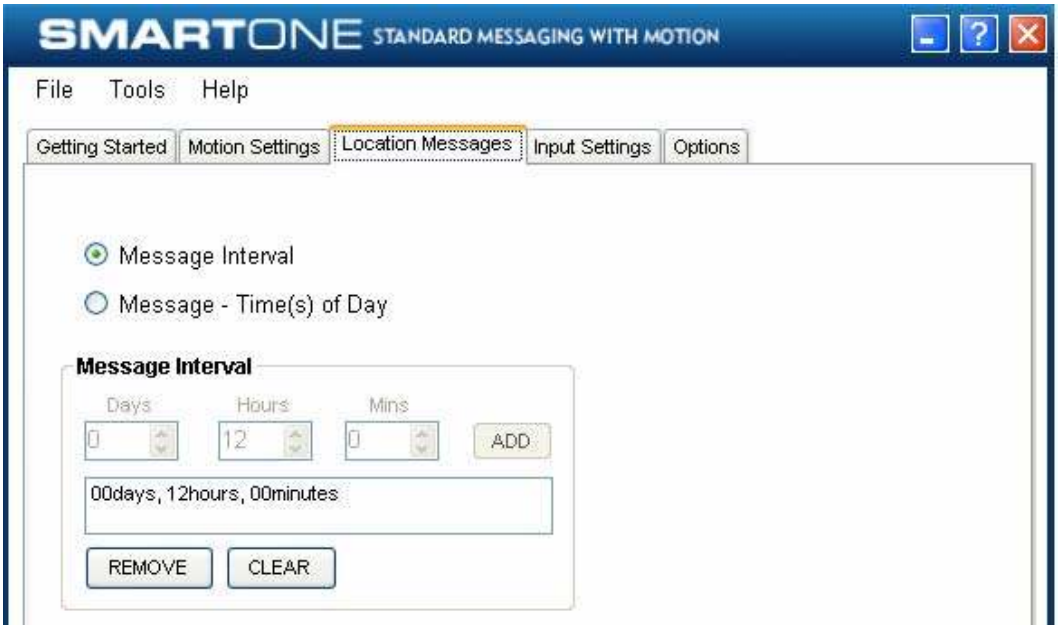


Level of Sensitivity for Vibration Sensor. The vibration sensor has a range of sensitivity from 1 to 31 (1 being most sensitive and 31 being least sensitive). The smaller the sensitivity level, the more sensitive the vibration sensor would be to movement.

Time to be in a State of Vibration. Time the vibration sensor must be above the sensitivity level before being in a State of Vibration. If the device senses continuous vibration for a period of time less than the specified in this parameter, the device will ignore the vibration and will not enter into a State of Vibration.

Time to be in a State of Lacking Vibration. Time the vibration sensor must be below the sensitivity level before in a State of Lacking Vibration.

Location Messages Tab



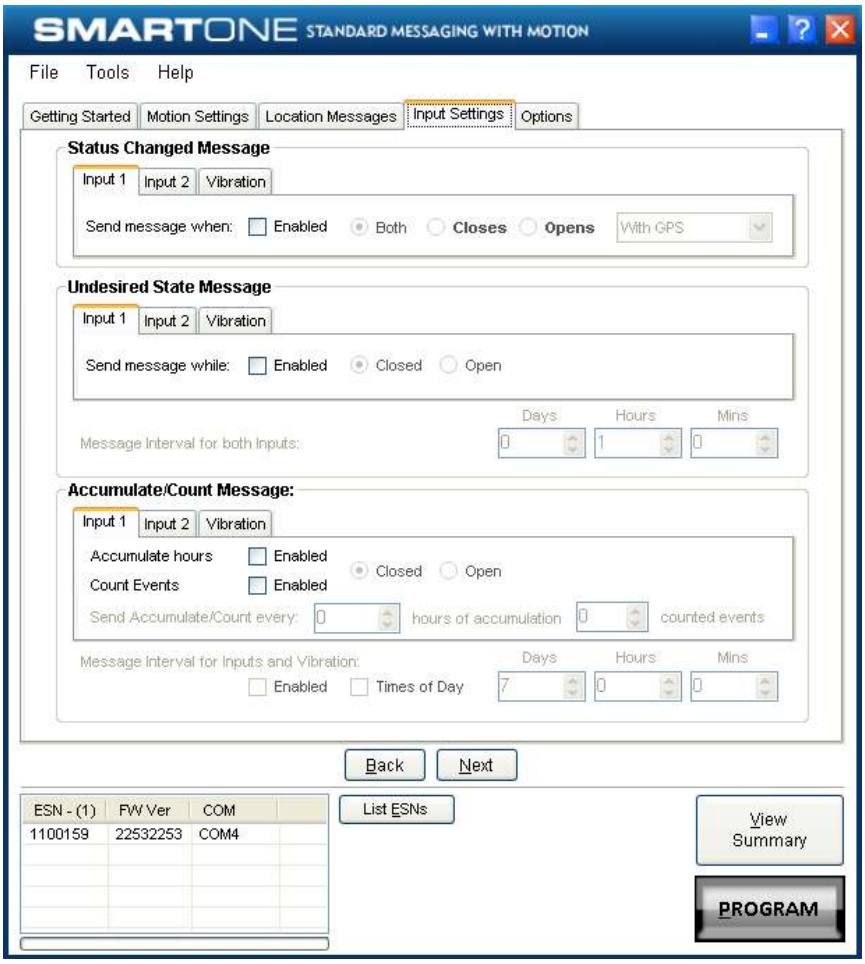
Message Interval. The **SMART**ONE can be configured to report at a specific message interval specified by days, hours and minutes. The **SMART**ONE accepts a single interval only.

Once the interval has been entered in Days, Hours, and Minutes, the ADD button will accept the interval and add it to the message interval box.

Message – Time(s) of Day. The **SMART**ONE can be configured to report at specific time (s) of day. The message interval box allows up to 12 times of day to send Location Messages.

The Remove button deletes the selected time of day or interval from the message interval box. The Clear button deletes all the time of days or interval in the message interval box.

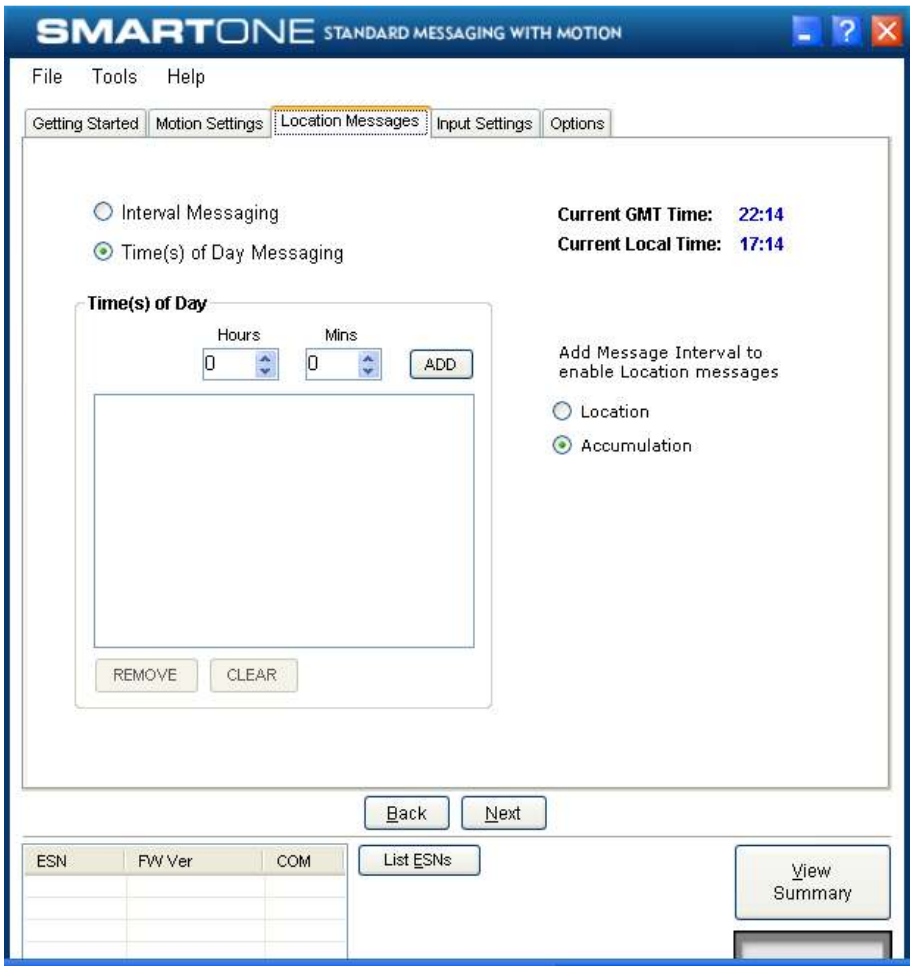
Input Settings Tab



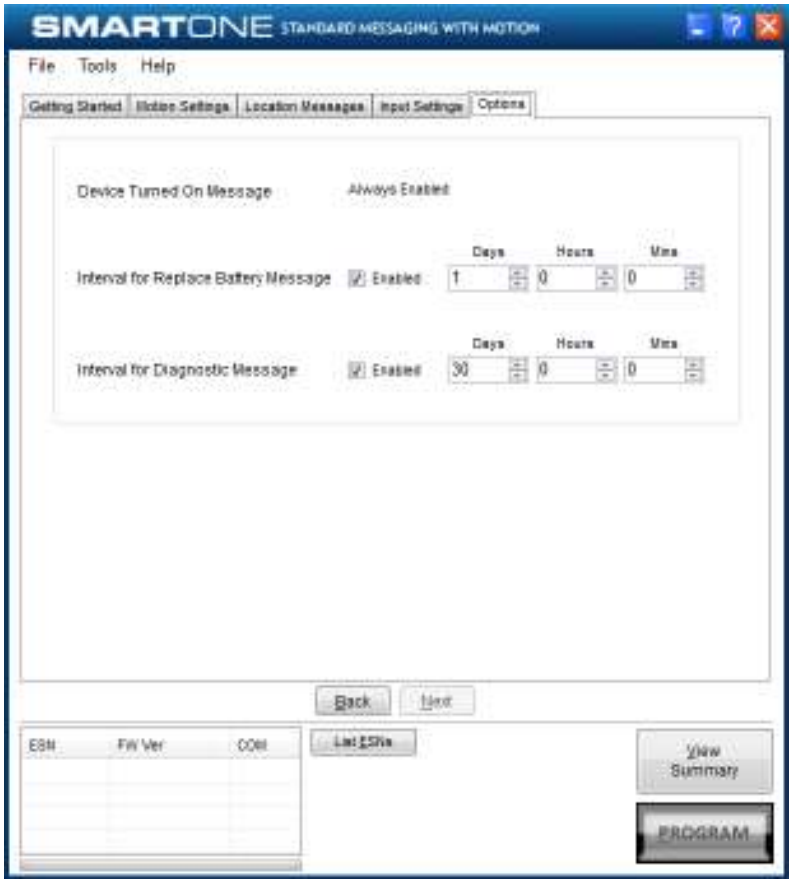
Status Changed Message. The **SMART**ONE has two inputs that can be configured to send a Status Changed Message once the selected input opens, closes, or in both events. The Message sent can or cannot contain the GPS coordinates of the device at the time the status of the input (s) changed. The SMARTONE can also send this message when it enters or exits the Vibration State.

Undesired State Message. The **SMART**ONE can be configured to send messages throughout the time the input is the desired state, either to opened or closed position. The message interval while the input is active can be configured in Days, Hours, and Minutes. Once the input is de-activated, the **SMART**ONE will return to the message interval or time (s) of day for Location Messages. The **SMART**ONE can also be configured to send messages throughout the time the device is in the State of Vibration.

Accumulate/Count Message: The **SMART**ONE can accumulate hours and events while input 1 or input 2 is enabled. The **SMART**ONE can send an accumulate/count message once the configurable number of hours or events have been reached. In addition, The **SMART**ONE can send the actual value of accumulated hours and events at configurable intervals specified in days, hours, and minutes. If Times of Day is selected, user will specify the times in the Location Message Tab.



Options Tab



Device Turned On Message. The **SMART**ONE is configured to send a Device Turned On Message on Power-up by default.

Interval for Replace Battery Message. The **SMART**ONE can be configured to transmit a Replace Battery message based on a low battery condition. Configuration range extends from 0 to 45 days in steps of a day. The default is 1 day.

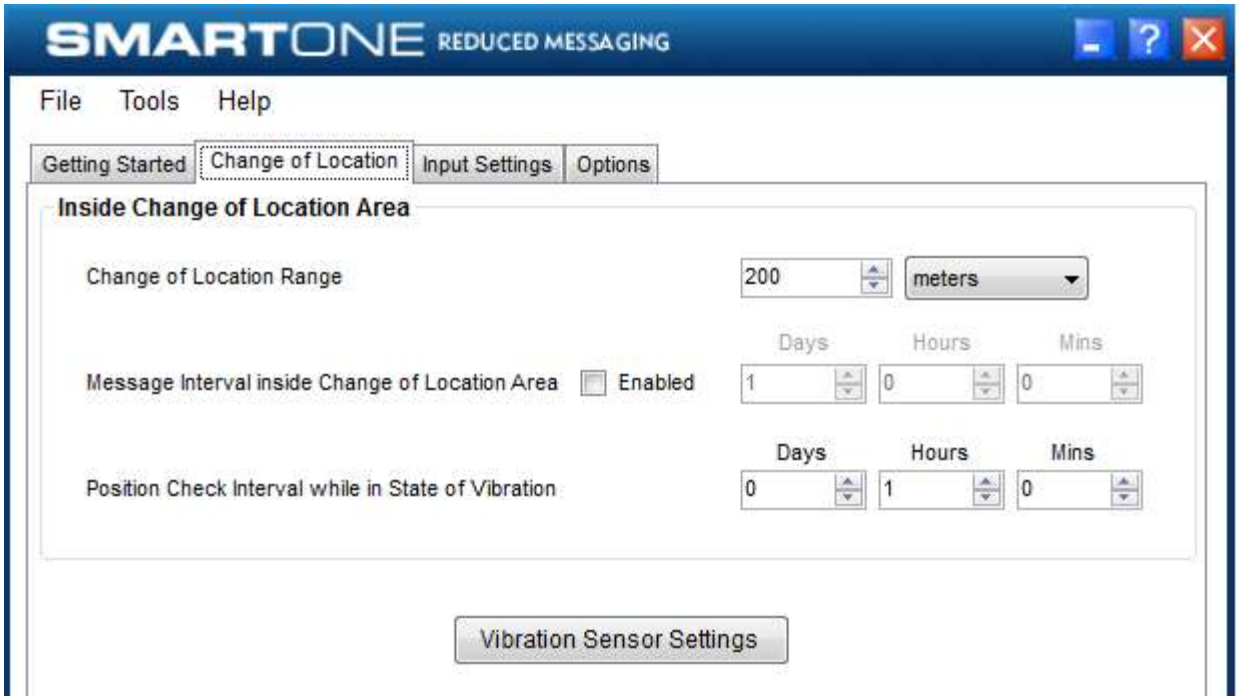
The **SMART**ONE will detect low battery conditions while at least 100 more messages can still be transmitted.

Interval for Diagnostic Message. The **SMART**ONE can send a diagnostic message with information on the diagnostic status of the device. The diagnostic message includes battery status, GPS average search time, GPS fails and number of transmissions since last diagnostic message.

Transmit interval of diagnostic messages with a transmission rate from 1 to 45 days. The default is 30 days.

Reduced Messaging Mode

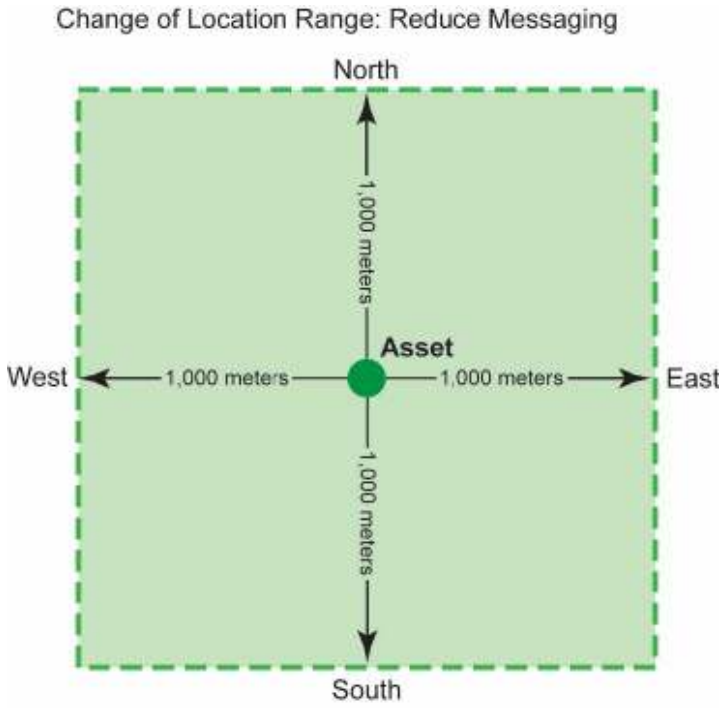
Change of Location Area Tab



Inside Change of Location Area

The parameters in this section define the functionality of the device while inside its Change of Location Area while in Reduced Messaging Mode.

Change of Location Range. Change of Location Range specifies the length (in meters, kilometers, yards, or miles) from the center of the Change of Location Area.

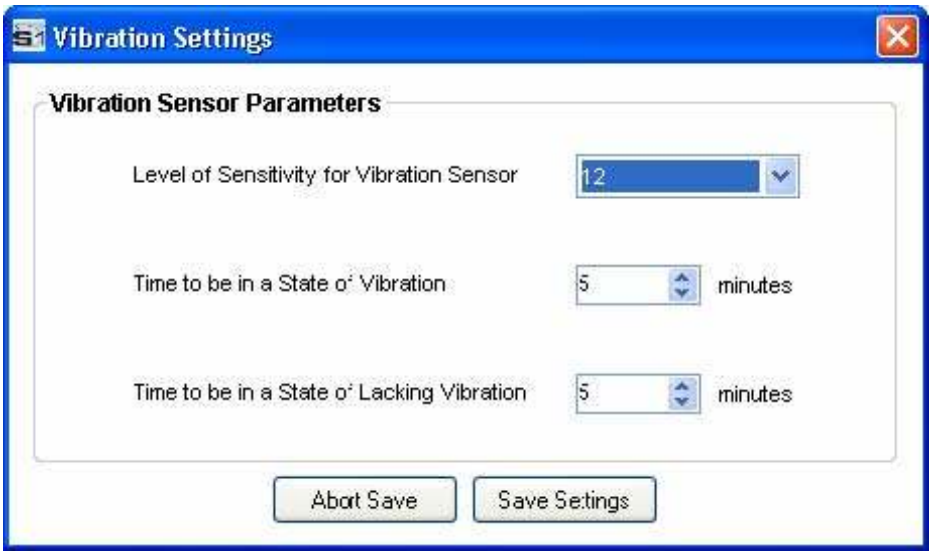


Message Interval inside the Change of Location Area. The **SMART**ONE can be configured to transmit messages while inside the Change of Location Area. This parameter allows you to configure the message interval inside the Change of Location Area in days, hours and minutes. In the Reduced

Messaging Mode, the asset will send infrequent messages if asset is in its Change of Location Area.

Position Check Interval while in State of Vibration. The **SMART**ONE can be configured to check GPS coordinates at a rate different from the transmission rate. This interval will determine the accuracy in time on how quickly the device will sense that it has left its Change of Location Area.

Vibration Sensor Settings Button. This button activates the Vibration Settings window. This window contains settings to define how the vibration sensor determines that the **SMART**ONE is In Motion. The parameters include Level of Sensitivity for Vibration Sensor, Time to be in a State of Vibration and the Time to be in a State of Lacking Vibration.

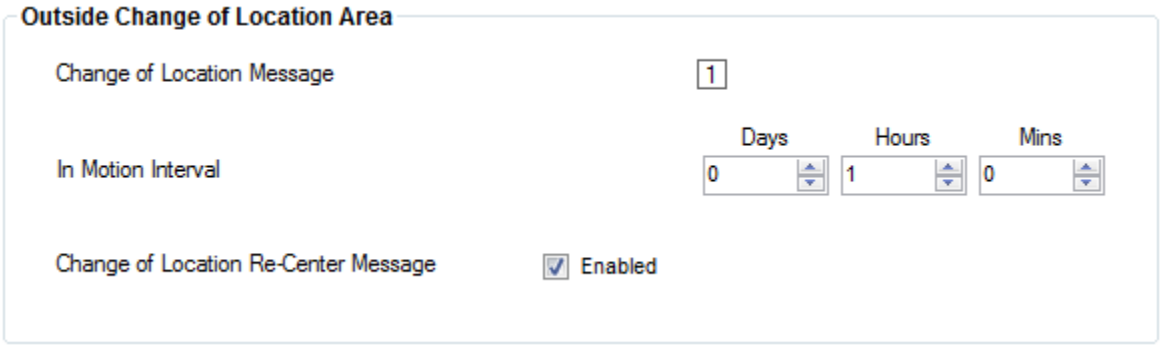


Level of Sensitivity for Vibration Sensor. The vibration sensor has a range of sensitivity from 1 to 31 (1 being most sensitive and 31 being least sensitive). The smaller the sensitivity level, the more sensitive the vibration sensor would be to movement.

Time to be in a State of Vibration. Time the vibration sensor must be above the sensitivity level before being in a State of Vibration. If the device senses continuous vibration for a period of time less than the specified in this parameter, the device will ignore the vibration and will not enter into a State of Vibration

Time to be in a State of Lacking Vibration. Time the vibration sensor must be below the sensitivity level before in a State of Lacking Vibration.

Outside Change of Location Area. The parameters in this section define the functionality of the device while outside its Change of Location Area.

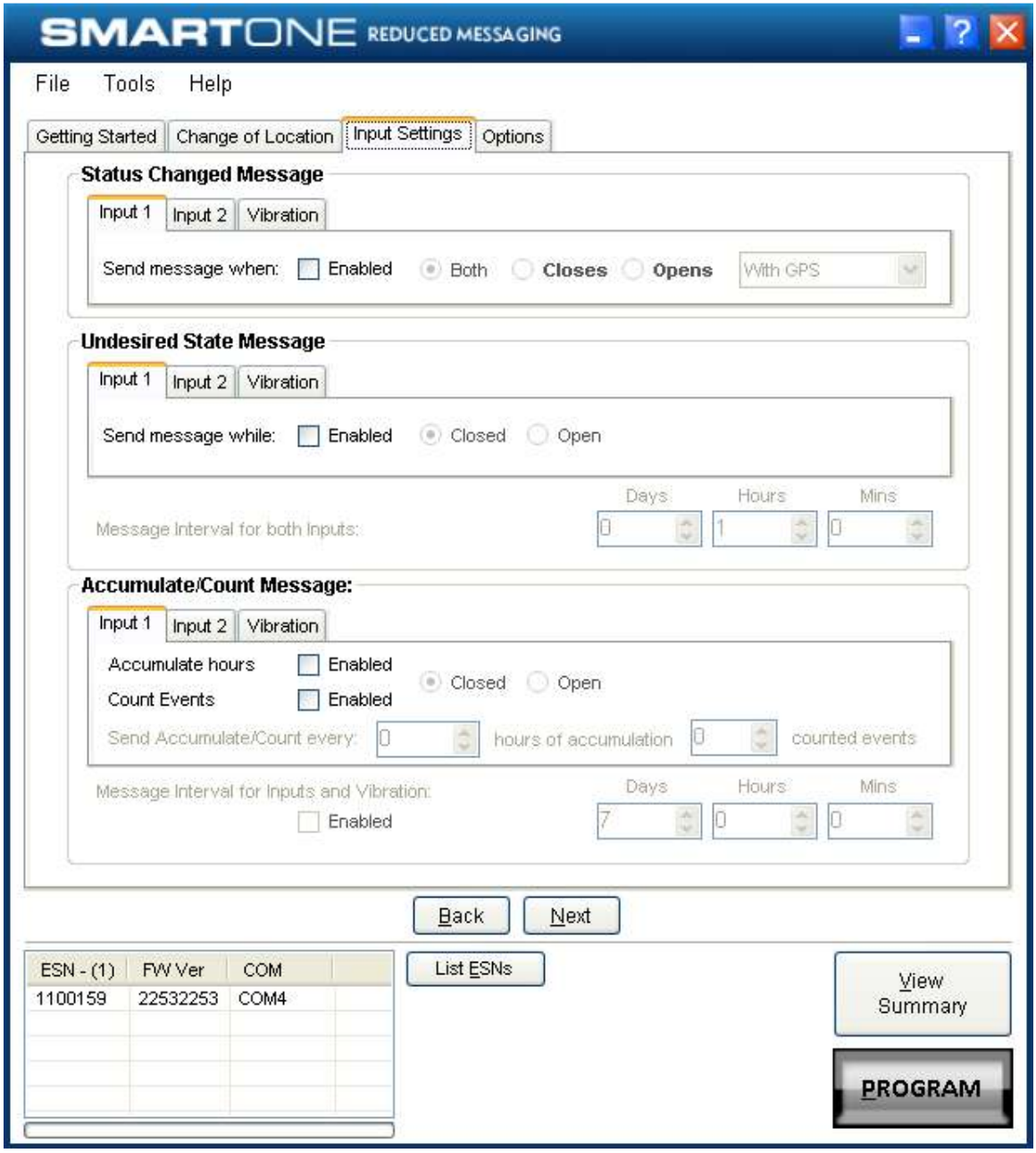


Change of Location Alert Message. The **SMART**ONE can be configured to send a Change of Location Area Alert message when the device leaves the Change of Location Area. This special message can be processed by the back office application to send a notification to a cellular phone or to an email account that the asset has left the Change of Location Area. The number of Change of Location Area Alert messages sent by the device is set to 1.

In Motion Interval. This parameter determines the message interval once device is outside the Change of Location Area and In Motion.

Change of Location Re-Center Message. Once the **SMART**ONE creates a new Change of Location Area after entering the At Rest State, it can or cannot send a Re-Center Message.

Input Settings Tab



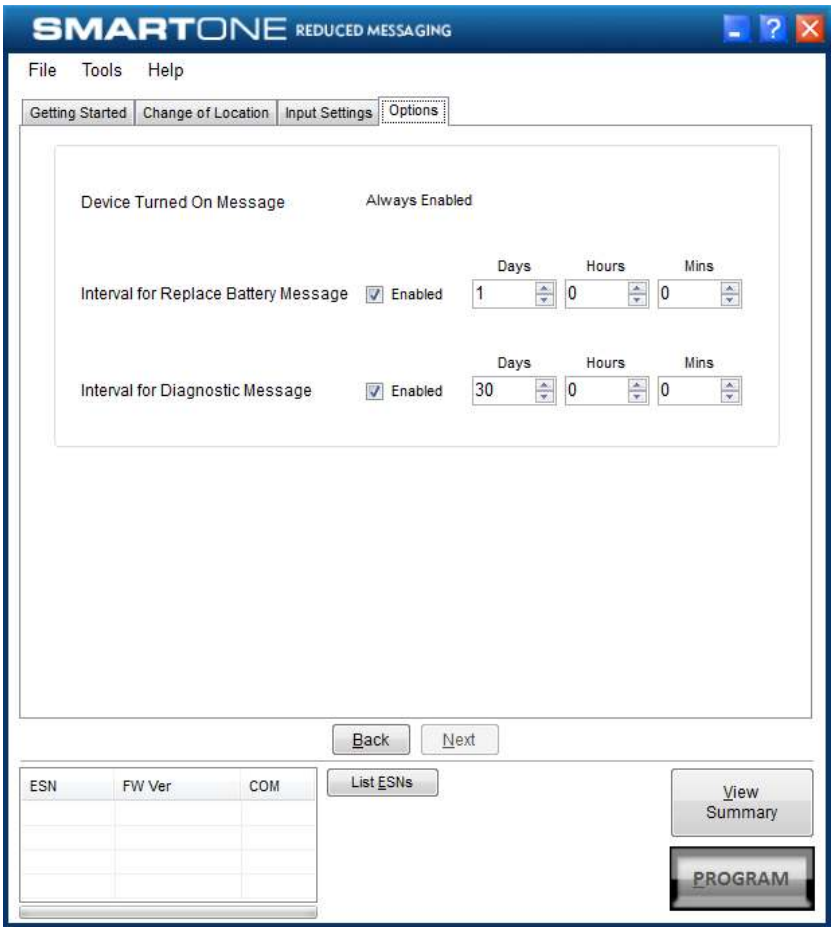
Status Changed Message. The **SMART**ONE has two inputs that can be configured to send a Status Changed Message once the selected input opens, closes, or in both events. The Message sent can or can not contain the GPS coordinates of the device at the time the status of the input (s) changed. The SMARTONE can also send this message when it enters or exits the Vibration State.

Undesired State Message. The **SMART**ONE can be configured to send messages throughout the time the input is in the desired state, either to opened or closed position. The message interval while the input is active can be configured in Days, Hours, and Minutes. Once the input is de activated, the **SMART**ONE will return to the message interval or time (s) of day for Location Messages. The **SMART**ONE can also be configured to send

messages throughout the time the device is in the State of Vibration.

Accumulate/Count Message: The **SMART**ONE can accumulate hours and events while input 1 or input 2 is enabled. The **SMART**ONE can send an accumulate/count message once the configurable number of hours or events have been reached. In addition, The **SMART**ONE can send the actual value of accumulated hours and events at configurable intervals specified in days, hours, and minutes.

Options Tab



Device Turned On Message. The **SMART**ONE is configured to send a Device Turned On Message on Power-up by default.

Interval for Replace Battery Message. The **SMART**ONE can be configured to transmit a Replace Battery message based on a low battery condition. Configuration range extends from 0 to 45 days in steps of a day. The default is 1 day.

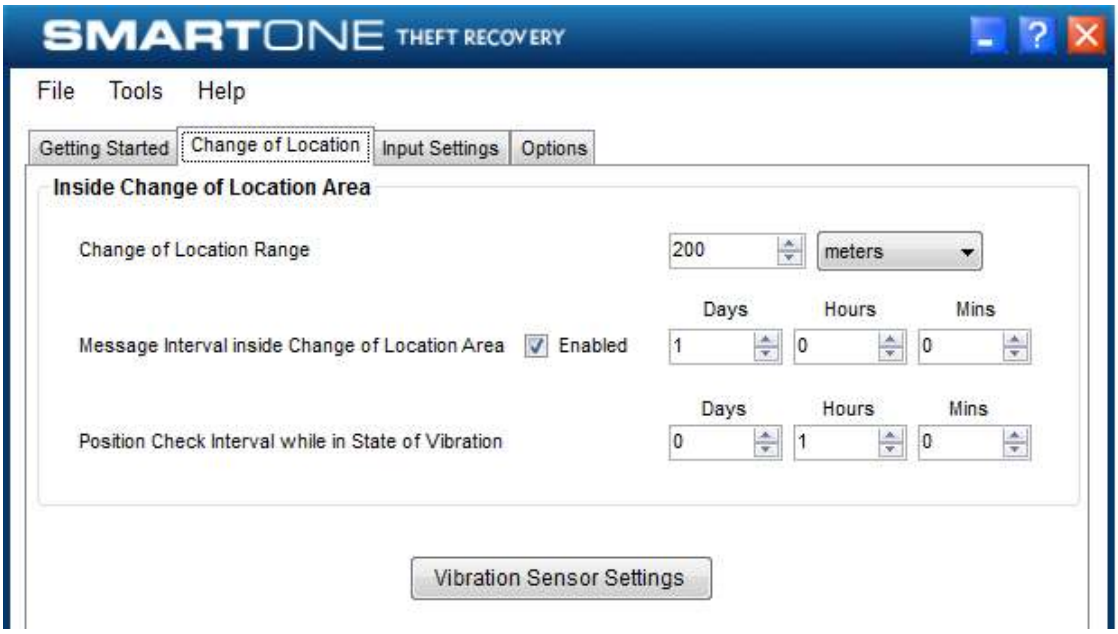
The **SMART**ONE will detect low battery conditions while at least 100 more messages can still be transmitted.

Interval for Diagnostic Message. The **SMART**ONE can send a diagnostic message with information on the diagnostic status of the device. The diagnostic message includes battery status, GPS average search time, GPS fails and number of transmissions since last diagnostic message.

Transmit interval of diagnostic messages with a transmission rate from 1 to 45 days. The default is 30 days.

Theft Recovery Mode

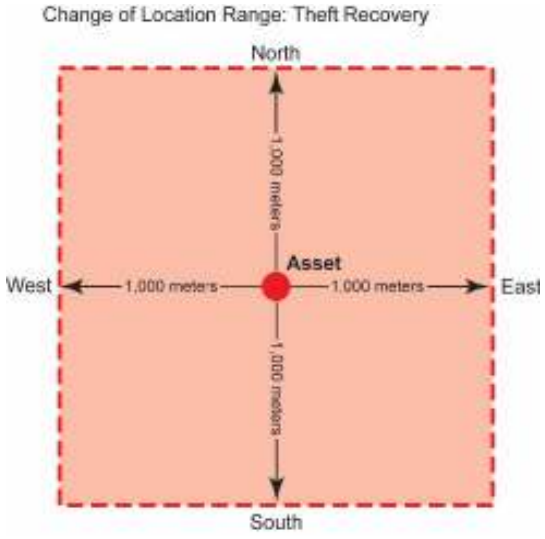
Change of Location Area Tab



Inside Change of Location Area Section

The parameters in this section define the functionality of the device while inside its Change of Location Area while in Theft Recovery Mode.

Change of Location Range. Change of Location Range specifies the length (in meters, kilometers, yards, or miles) from the center of the Change of Location Area. If the **SMART**ONE detects that it has left its Change of Location Area, the device will enter into a Recovery Mode witch is defined by the In Motion Interval within Outside Change of Location Area.



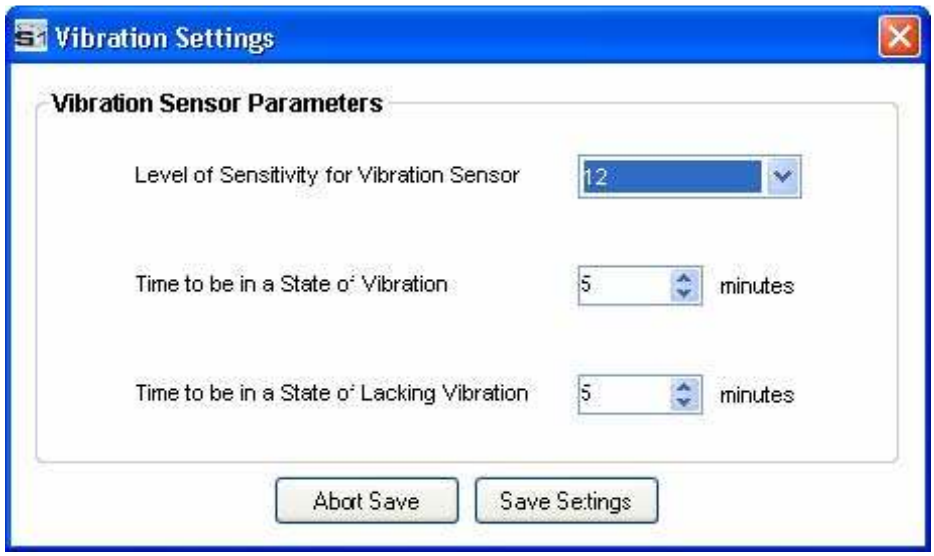
Message Interval inside the Change of Location Area. The **SMART**ONE can be configured to transmit messages while inside its Change of Location Area. This parameter allows you to configure the message interval inside the Change of Location Area in days, hours and minutes. In Theft

Recovery Mode, the asset will send infrequent messages, user configurable interval, if asset is in its Change of Location Area.

Position Check Interval while in State of Vibration. The **SMART**ONE can be configured to check GPS coordinates at a rate different from the transmission rate. This interval will determine the accuracy in time on how quickly the device will sense that it has left its authorized Change of Location Area.

The **SMART**ONE has the ability to get GPS fixes without transmitting the information to Globalstar Simples network. It uses the information to confirm if it is inside its Change of Location Area.

Vibration Sensor Settings Button. This button activates the Vibration Settings window. This window contains settings to define how the vibration sensor determines that the **SMART**ONE is In Motion. The parameters include Level of Sensitivity for Vibration Sensor and Time to be in a State of Vibration and the Time to be in a State of Lacking Vibration.



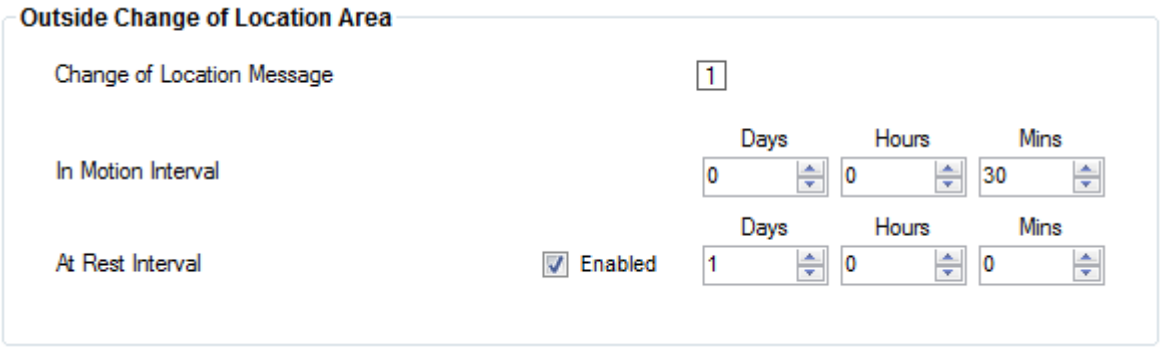
Level of Sensitivity for Vibration Sensor. The vibration sensor has a range of sensitivity from 1 to 31 (1 most sensitive and 31 least sensitive). The smaller the sensitivity level, the more sensitive the vibration sensor would be to movement.

Time to be in a State of Vibration. Time the vibration sensor must be above the sensitivity level before being in a State of Vibration. If the device senses continuous vibration for a period of time less than the specified in this parameter, the device will ignore the vibration and will not enter into a State of Vibration

Time to be in a State of Lacking Vibration. Time the vibration sensor must be below the sensitivity level before in a State of Lacking Vibration.

Outside Change of Location Area

The parameters in this section define the functionality of the device while outside its Change of Location Area.



Change of Location Alert Messages. The **SMART**ONE can be configured to send a Change of Location Area Alert message when the device leaves the Change of Location Area. This special message can be processed by the back office application to send a notification to a cellular phone or to an email account that the asset has left the authorized Change of Location Area.

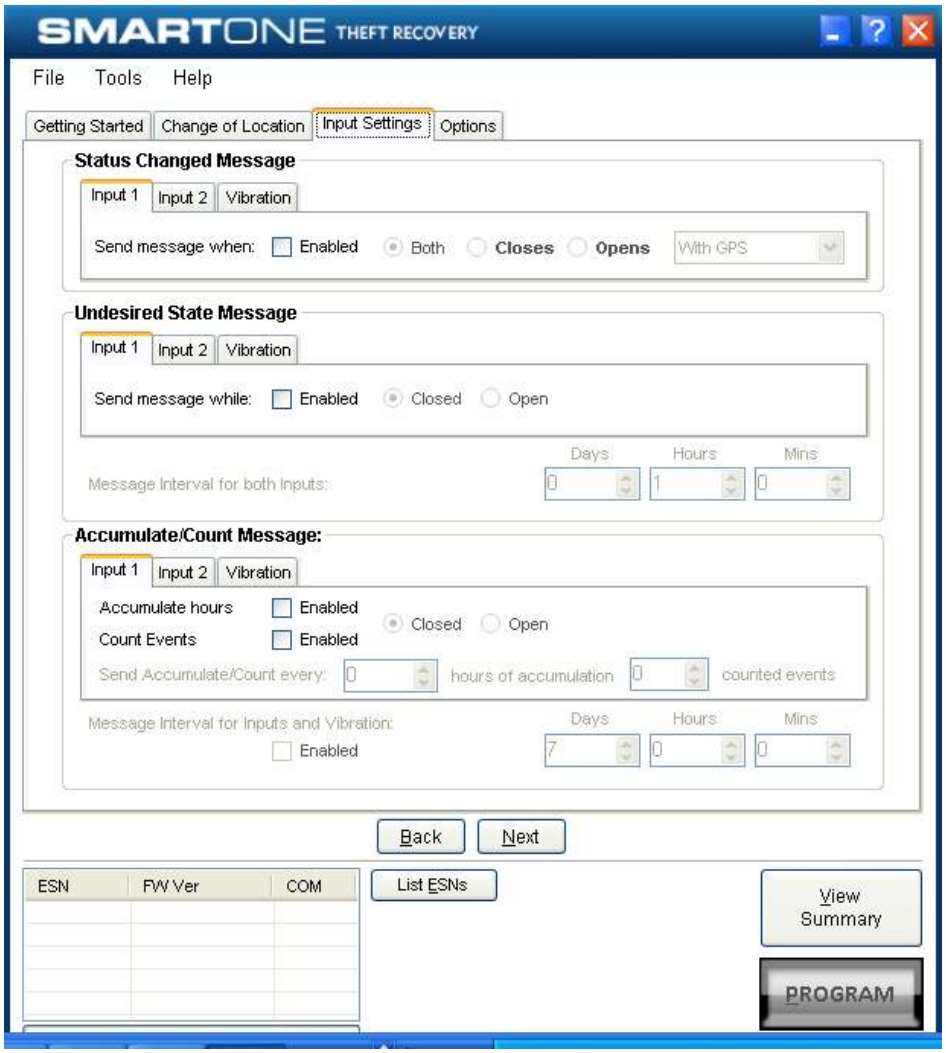
In Motion Interval. This parameter determines the message interval once device is outside the Change of Location Area and In Motion.

In Theft Recovery Mode, the device will continue to send messages outside it Change of Location Area at the specified In Motion message interval until the device is Re-Centered by turning the connector in the device in the OFF and ON position.

The device will create a new Change of Location Area in the Theft Recovery Mode immediately after turning ON the device using the connector.

At Rest Interval. This parameter determines the message interval once device is outside the Change of Location Area and At Rest. The device is considered to be at rest when the comparison of a new GPS reading to a previous GPS reading indicates that the tracker has not changed location by more than a specified minimum distance.

Input Settings Tab



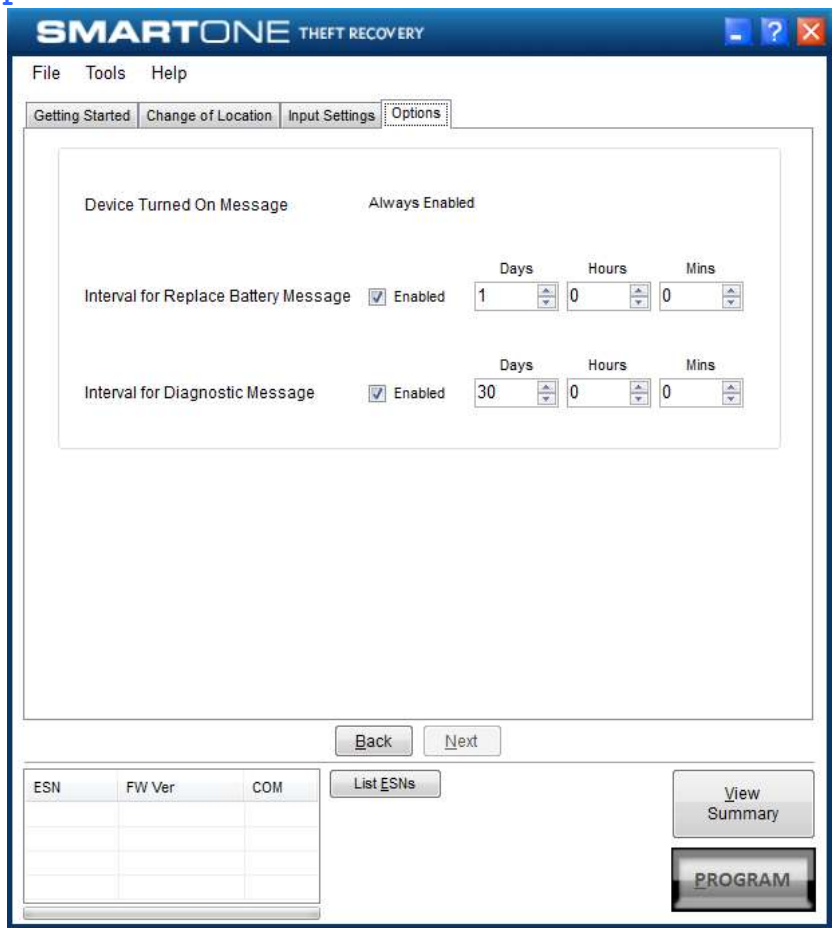
Status Changed Message. The **SMART**ONE has two inputs that can be configured to send a Status Changed Message once the selected input opens, closes, or in both events. The Message sent can or can not contain the GPS coordinates of the device at the time the status of the input (s) changed. The SMARTONE can also send this message when it enters or exits the Vibration State.

Undesired State Message. The **SMART**ONE can be configured to send messages throughout the time the input in the desired state message, either to opened or closed position. The message interval while the input is active can be configured in Days, Hours, and Minutes. Once the input is de-activated, the **SMART**ONE will return to the message interval or time (s) of day for Location Messages. The **SMART**ONE can also be configured to send messages throughout the time the device is in the State of Vibration.

Accumulate/Count Message. The **SMART**ONE can accumulate hours and events while input 1 or input 2 is enabled. The **SMART**ONE can send an accumulate/count message once the configurable number of hours or events

have been reached. In addition, The **SMART**ONE can send the actual value of accumulated hours and events at configurable intervals specified in days, hours, and minutes.

Options Tab



Device Turned On Message. The SMARTONE is configured to send a Device Turned On Message on Power-up. The default is enabled.

Interval for Replace Battery Message. The **SMART**ONE can be configured to transmit a Replace Battery message based on a low battery condition. Configuration range extends from 0 to 45 days in steps of a day. The default is 1 day.

The **SMART**ONE will detect low battery conditions while at least 100 more messages can still be transmitted.

Interval for Diagnostic Message. The **SMART**ONE can send a diagnostic message with information on the diagnostic status of the device. The diagnostic message includes battery status, GPS average search time, GPS fails and number of transmissions since last diagnostic message.

Transmit interval of diagnostic messages with a transmission rate from 1 to 45 days. The default is 30 days.

Messages

The **SMART**ONE produces on-air messages conforming to the Globalstar specified format.

The data being communicated to the end user is contained entirely in the 72 bit (9 byte) field.

This section will describe the use of the 9 byte user information segment for communicating the range of information that the **SMART**ONE is able to convey to the user.

User information is sometimes referred to as the message payload.

Basic User Information

Global Message Type

Bits 0 and 1 in the first byte of the user data define the Global Message Type; there are four total global types. Types 0 and 3 are applicable to the function and features of the **SMART**ONE, type 1 and 2 are user defined message types.

Type 0: Standard Message: All of the various message types that contain Latitude and Longitude data that are transmitted by the **SMART**ONE will be of this type.

Type 1: Truncated Message: This message type provides for up to 2 bytes plus 6 bits of user data to be appended to the status byte and GPS location information.

Type 2: Raw Message: This message type provides for up to 8 bytes plus 6 bits of user data.

Type 3: Non Standard Message: This is the message type that covers the category "none of the above". The **SMART**ONE will use this message type for messages that do not contain Latitude and Longitude data. Smart One message types which fall into this category include Accumulate/Count messages, Diagnostic messages, Contact Service Provider messages and Low Battery messages.

Type 0 Message Class

Message Format

Table 1 below shows the format of all standard messages. Specific variants of the message will be shown individually in following

subsections.

Byte Number	Variable	Bits	Description
0	Type field	2	Bit (1:0) = 0 = message type:
0	Battery state	1	Bit (2) 0 = Good battery. 1 = replace battery.
0	GPS Data Valid	1	Bit (3) 0 = GPS Data valid in this message. 1 = GPS failed in this message cycle, ignore Latitude and Longitude fields.
0	Missed Input State Change	2	Bit (4) Missed Input 1. A value of 1 in this bit means that an input state change of input 1 was missed due to the transmission of a higher priority message. Bit (5) = Missed Input 2. A value of 1 in this bit means that an input state change of Input 2 was missed due to the transmission of a higher priority message.
0	GPS fail counter	2	Bit (7:6) = GPS fail counter. Counts up to a maximum value of 3 upon GPS failure.
1,2,3,4,5,6	Latitude/Longitude	48	Byte 1 = Latitude MSByte Byte 2 = Latitude Byte 3 = Latitude LSByte Byte 4 = Longitude MSByte Byte 5 = Longitude Byte 6 = Longitude LSByte 360 degrees of Longitude coded in signed binary with 3 bytes and 180 degrees of Latitude coded in signed binary with 3 bytes. Positive Longitudes correspond to East Longitudes Positive Latitudes correspond to North Latitudes
7	Input Status	4	These bits reflect the state of the inputs and indicate which one, if any, triggered an Input Status Changed message. Bit 0: Input 1 change: 0 = Did not trigger message, 1 = Triggered message. Bit 1: Input 1 state: 0 = Closed, 1 = Open Bit 2: Input 2 change: 0 = Did not trigger message, 1 = Triggered message Bit 3: Input 2 state: 0 = Closed, 1 = Open
7	Message Sub-Type	4	Bits (7:4) message sub-type

			code. See subtypes below.
8	RESERVED	3	Bits (2:0) RESERVED in SmartOne
8	Vibration triggered message	1	Bit (3) – Value 1 = This message is being sent because transmit on change of vibration state is selected and the vibration just changed state, or Undesired Vibration state is selected and the vibration is in the undesired state. Value 0 = This message is being transmitted for a reason other than the above reasons.
8	Vibration bit.	1	Bit (4) – Value 1 = Unit is in a state of vibration. Value 0 = Unit is not in a state of vibration.
8	2D	1	Bit (5) – Value 1 = GPS data reported is from a 2D fix. (Only 3 satellites were used in the fix.) Value 0 = GPS data reported is from a 3D fix.
8	Motion	1	Bit (6) – Value 1 = Device was In-Motion when the message was transmitted. Value 0 = Device was At-Rest when the message was transmitted.
8	Fix Confidence Bit.	1	Bit (7) 0=High confidence in GPS fix accuracy, 1=Reduced confidence in GPS fix accuracy.

Table 1 – Message Format

Location Message

This is the message that is transmitted on an interval. When this message is received, it indicates that the transmission is due to a scheduled interval at either the At Rest rate or In Motion rate. Whether the device is At Rest or In Motion can be determined by the motion bit.

The Location Message Subtype field of this message, contained in byte 7, has a value of zero 0. The format of the Location Message is shown in Table 2.

Byte Number	Variable	Bits	Description
0	Type field	2	Bit (1:0) = 0 = standard message type
0	Battery state	1	Bit (2) 0 = Good battery. 1 = replace battery.
0	GPS Data Valid	1	Bit (3) 0 = GPS Data valid in this message. 1 = GPS failed

			in this message cycle, ignore Latitude and Longitude fields.
0	Missed Input State Change	2	Bit (4) Missed Input 1. A value of 1 in this bit means that an input state change of Input 1 was missed due to the transmission of a higher priority message. Bit (5) = Missed Input 2. A value of 1 in this bit means that an input state change of Input 2 was missed due to the transmission of a higher priority message.
0	GPS fail counter	2	Bit (7:6) = GPS fail counter. Counts up to a maximum value of 3 upon GPS failure.
1,2,3,4,5,6	Latitude/Longitude	48	Byte 1 = Latitude MSByte Byte 2 = Latitude Byte 3 = Latitude LSByte Byte 4 = Longitude MSByte Byte 5 = Longitude Byte 6 = Longitude LSByte 360 degrees of Longitude coded in signed binary with 3 bytes and 180 degrees of Latitude coded in signed binary with 3 bytes. Positive Longitudes correspond to East Longitudes Positive Latitudes correspond to North Latitudes
7	Input Status	4	These bits reflect the state of the inputs and indicate which one, if any, triggered an Input Status Changed message. Bit 0: Input 1 change: 0 = Did not trigger message, 1 = Triggered message. Bit 1: Input 1 state: 0 = Closed, 1 = Open Bit 2: Input 2 change: 0 = Did not trigger message, 1 = Triggered message Bit 3: Input 2 state: 0 = Closed, 1 = Open
7	Standard Message Sub-Type	4	Bits (7:4) Standard message sub-type code. Value is 0 in the location message.
8	RESERVED	3	Bits (2:0) RESERVED in SmartOne
8	Vibration triggered message	1	Bit (3) – Value 1 = This message is being sent because transmit on change of vibration state is selected and the vibration just changed state, or Undesired Vibration state is selected and the vibration is

			in the undesired state. Value 0 = This message is being transmitted for a reason other than the above reasons.
8	Vibration bit.	1	Bit (4) – Value 1 = Unit is in a state of vibration. Value 0 = Unit is not in a state of vibration.
8	2D	1	Bit (5) – Value 1 = GPS data reported is from a 2D fix. (Only 3 satellites were used in the fix.) Value 0 = GPS data reported is from a 3D fix.
8	Motion	1	Bit (6) – Value 1 = Device was In-Motion when the message was transmitted. Value 0 = Device was At-Rest when the message was transmitted.
8	Fix Confidence Bit.	1	Bit (7) 0=High confidence in GPS fix accuracy, 1=Reduced confidence in GPS fix accuracy.

Table 2 – Location Message

Device Turned On Message

This is the message transmitted at power on. It is a Standard message with a message sub-type value of 1. Message format is shown in table 3.

Byte Number	Variable	Bits	Description
0	Type field	2	Bit (1:0) = 0 = standard message type:
0	Battery state	1	Bit (2) 0 = Good battery. 1 = replace battery.
0	GPS Data Valid	1	Bit (3) 0 = GPS Data valid in this message. 1 = GPS failed in this message cycle, ignore Latitude and Longitude fields.
0	Missed Input State Change	2	Bit (4) Missed Input 1. A value of 1 in this bit means that an input state change of Input 1 was missed due to the transmission of a higher priority message. Bit (5) = Missed Input 2. A value of 1 in this bit means that an input state change of Input 2 was missed due to the transmission of a higher priority message.
0	GPS fail counter	2	Bit (7:6) = GPS fail counter. Counts up to a maximum value of 3 upon GPS failure.
1,2,3,4,5,6	Latitude/Longitude	48	Byte 1 = Latitude MSByte Byte 2 = Latitude Byte 3 = Latitude LSByte Byte 4 = Longitude MSByte

			Byte 5 = Longitude Byte 6 = Longitude LSByte 360 degrees of Longitude coded in signed binary with 3 bytes and 180 degrees of Latitude coded in signed binary with 3 bytes. Positive Longitudes correspond to East Longitudes Positive Latitudes correspond to North Latitudes
7	Input Status	4	These bits reflect the state of the inputs and indicate which one, if any, triggered an Input Status Changed message. Bit 0: Input 1 change: 0 = Did not trigger change message, 1 = Triggered message. Bit 1: Input 1 state: 0 = Closed, 1 = Open Bit 2: Input 2 change: 0 = Did not trigger message, 1 = Triggered message Bit 3: Input 2 state: 0 = Closed, 1 = Open
7	Standard Message Sub-Type	4	Bits (7:4) Standard message sub-type code. Value is 1 in the Device Turned On message.
8	RESERVED	3	Bits (2:0) RESERVED in SmartOne
8	Vibration triggered message	1	Bit (3) – Value 1 = This message is being sent because transmit on change of vibration state is selected and the vibration just changed state, or Undesired Vibration state is selected and the vibration is in the undesired state. Value 0 = This message is being transmitted for a reason other than the above reasons.
8	Vibration bit.	1	Bit (4) – Value 1 = Unit is in a state of vibration. Value 0 = Unit is not in a state of vibration.
8	2D	1	Bit (5) – Value 1 = GPS data reported is from a 2D fix. (Only 3 satellites were used in the fix.) Value 0 = GPS data reported is from a 3D fix.
8	Motion	1	Bit (6) – Value 1 = Device was In-Motion when the message was transmitted. Value 0 = Device was At-Rest when the message was transmitted.
8	Fix Confidence Bit.	1	Bit (7) 0=High confidence in GPS fix accuracy, 1=Reduced confidence in GPS fix accuracy.

Table 3 - Device Turned On message

Change of Location Area Alert Message

This is the message transmitted when the **SMART**ONE detects that it has left its Change of Location Area.

The Standard Message Subtype field of this message, contained in byte 7, has a value of two 2. The format of the Change of Location Area Alert Message is shown in Table 4.

Byte Number	Variable	Bits	Description
0	Type field	2	Bit (1:0) = 0 = Standard message type:
0	Battery state	1	Bit (2) 0 = Good battery. 1 = replace battery.
0	GPS Data Valid	1	Bit (3) 0 = GPS Data valid in this message. 1 = GPS failed in this message cycle, ignore Latitude and Longitude fields.
0	Missed Input State Change	2	Bit (4) Missed Input 1. A value of 1 in this bit means that an input state change of Input 1 was missed due to the transmission of a higher priority message. Bit (5) = Missed Input 2. A value of 1 in this bit means that an input state change of Input 2 was missed due to the transmission of a higher priority message.
0	GPS fail counter	2	Bit (7:6) = GPS fail counter. Counts up to a maximum value of 3 upon GPS failure.
1,2,3,4,5,6	Latitude/Longitude	48	Byte 1 = Latitude MSByte Byte 2 = Latitude Byte 3 = Latitude LSByte Byte 4 = Longitude MSByte Byte 5 = Longitude Byte 6 = Longitude LSByte 360 degrees of Longitude coded in signed binary with 3 bytes and 180 degrees of Latitude coded in signed binary with 3 bytes. Positive Longitudes correspond to East Longitudes Positive Latitudes correspond to North Latitudes
7	Input Status	4	These bits reflect the state of

			the inputs and indicate which one, if any, triggered an Input Status Changed message. Bit 0: Input 1 change: 0 = Did not trigger message, 1 = Triggered message. Bit 1: Input 1 state: 0 = Closed, 1 = Open Bit 2: Input 2 change: 0 = Did not trigger message, 1 = Triggered message Bit 3: Input 2 state: 0 = Closed, 1 = Open
7	Standard Message Sub-Type	4	Bits (7:4) Standard message sub-type code. Value is 2 in the Change of Location Area alert message.
8	RESERVED	3	Bits (2:0) RESERVED in SmartOne
8	Vibration triggered message	1	Bit (3) – Value 1 = This message is being sent because transmit on change of vibration state is selected and the vibration just changed state, or Undesired Vibration state is selected and the vibration is in the undesired state. Value 0 = This message is being transmitted for a reason other than the above reasons.
8	Vibration bit.	1	Bit (4) – Value 1 = Unit is in a state of vibration. Value 0 = Unit is not in a state of vibration.
8	2D	1	Bit (5) – Value 1 = GPS data reported is from a 2D fix. (Only 3 satellites were used in the fix.) Value 0 = GPS data reported is from a 3D fix.
8	Motion	1	Bit (6) – Value 1 = Device was In-Motion when the message was transmitted. Value 0 = Device was At-Rest when the message was transmitted.
8	Fix Confidence Bit.	1	Bit (7) 0=High confidence in GPS fix accuracy, 1=Reduced confidence in GPS fix accuracy.

Table 4 – Change of Location Area Alert Message

Input Status Changed Message

This is the message that will be transmitted upon the change of state of the inputs if enabled and as selected by the user Input 1 open, input 1 closed, input 1 both, input 2 open, input 2 closed, input 2 both. The Message Sub Type is 3. The Input status value of byte 7 in the message indicates which input changed state to trigger the message and also

reports the states of both inputs. The message format is shown in table 5.

Byte Number	Variable	Bits	Description
0	Type field	2	Bit (1:0) = 0 = Standard message type:
0	Battery state	1	Bit (2) 0 = Good battery. 1 = replace battery.
0	GPS Data Valid	1	Bit (3) 0 = GPS Data valid in this message. 1 = GPS failed in this message cycle, ignore Latitude and Longitude fields.
0	Missed Input State Change	2	Bit (4) Missed Input 1. A value of 1 in this bit means that an input state change of Input 1 was missed due to the transmission of a higher priority message. Bit (5) = Missed Input 2. A value of 1 in this bit means that an input state change of Input 2 was missed due to the transmission of a higher priority message.
0	GPS fail counter	2	Bit (7:6) = GPS fail counter. Counts up to a maximum value of 3 upon GPS failure.
1,2,3,4,5,6	Latitude/Longitude	48	Byte 1 = Latitude MSByte Byte 2 = Latitude Byte 3 = Latitude LSByte Byte 4 = Longitude MSByte Byte 5 = Longitude Byte 6 = Longitude LSByte 360 degrees of Longitude coded in signed binary with 3 bytes and 180 degrees of Latitude coded in signed binary with 3 bytes. Positive Longitudes correspond to East Longitudes Positive Latitudes correspond to North Latitudes
7	Input Status	4	These bits reflect the state of the inputs and indicate which one, if any, triggered an Input Status Changed message. Bit 0: Input 1 change: 0 = Did not trigger message, 1 = Triggered message. Bit 1: Input 1 state: 0 = Closed, 1 = Open Bit 2: Input 2 change: 0 = Did not trigger message, 1 = Triggered message Bit 3: Input 2 state: 0 = Closed, 1 = Open
7	Standard Message	4	Bits (7:4) Standard message

	Sub-Type		sub-type code. Value is 3 in the Input Status Changed message.
8	RESERVED	3	Bits (2:0) RESERVED in SmartOne
8	Vibration triggered message	1	Bit (3) – Value 1 = This message is being sent because transmit on change of vibration state is selected and the vibration just changed state, or Undesired Vibration state is selected and the vibration is in the undesired state. Value 0 = This message is being transmitted for a reason other than the above reasons.
8	Vibration bit.	1	Bit (4) – Value 1 = Unit is in a state of vibration. Value 0 = Unit is not in a state of vibration.
8	2D	1	Bit (5) – Value 1 = GPS data reported is from a 2D fix. (Only 3 satellites were used in the fix.) Value 0 = GPS data reported is from a 3D fix.
8	Motion	1	Bit (6) – Value 1 = Device was In-Motion when the message was transmitted. Value 0 = Device was At-Rest when the message was transmitted.
8	Fix Confidence Bit.	1	Bit (7) 0=High confidence in GPS fix accuracy, 1=Reduced confidence in GPS fix accuracy.

Table 5 – Input Status Changed Message

Undesired Input State Message

This is the message that is transmitted when the user has selected for an undesired input state to cause a different report rate. When this Mode is enabled, the user defined Undesired Input State report rate supersedes the At Rest and In Motion report rates when the input(s) is (are) in an undesired state. The Sub-Type value of this message is 4. The Input Status portion of byte 7 will indicate which input(s) are in the undesired state and triggering the Undesired Input State report rate. The message format is shown in table 6.

Byte Number	Variable	Bits	Description
0	Type field	2	Bit (1:0) = 0 = Standard message type:
0	Battery state	1	Bit (2) 0 = Good battery. 1 = replace battery.
0	GPS Data Valid	1	Bit (3) 0 = GPS Data valid in

			this message. 1 = GPS failed in this message cycle, ignore Latitude and Longitude fields.
0	Missed Input State Change	2	Bit (4) Missed Input 1. A value of 1 in this bit means that an input state change of Input 1 was missed due to the transmission of a higher priority message. Bit (5) = Missed Input 2. A value of 1 in this bit means that an input state change of Input 2 was missed due to the transmission of a higher priority message.
0	GPS fail counter	2	Bit (7:6) = GPS fail counter. Counts up to a maximum value of 3 upon GPS failure.
1,2,3,4,5,6	Latitude/Longitude	48	Byte 1 = Latitude MSByte Byte 2 = Latitude Byte 3 = Latitude LSByte Byte 4 = Longitude MSByte Byte 5 = Longitude Byte 6 = Longitude LSByte 360 degrees of Longitude coded in signed binary with 3 bytes and 180 degrees of Latitude coded in signed binary with 3 bytes. Positive Longitudes correspond to East Longitudes Positive Latitudes correspond to North Latitudes
7	Input Status	4	These bits reflect the state of the inputs and indicate which one, if any, triggered an Undesired Input State message. Bit 0: Input 1: 0 = Desired, 1 =Undesired. Bit 1: Input 1 state: 0 = Closed, 1 = Open Bit 2: Input 2: 0 = Desired, 1 = Undesired Bit 3: Input 2 state: 0 = Closed, 1 = Open
7	Standard Message Sub-Type	4	Bits (7:4) Standard message sub-type code. Value is 4 in the undesired input state message.
8	RESERVED	3	Bits (2:0) RESERVED in SmartOne
8	Vibration triggered message	1	Bit (3) – Value 1 = This message is being sent because transmit on change of vibration state is selected and the vibration just changed state, or Undesired Vibration state is selected and the vibration is

			in the undesired state. Value 0 = This message is being transmitted for a reason other than the above reasons.
8	Vibration bit.	1	Bit (4) – Value 1 = Unit is in a state of vibration. Value 0 = Unit is not in a state of vibration.
8	2D	1	Bit (5) – Value 1 = GPS data reported is from a 2D fix. (Only 3 satellites were used in the fix.) Value 0 = GPS data reported is from a 3D fix.
8	Motion	1	Bit (6) – Value 1 = Device was In-Motion when the message was transmitted. Value 0 = Device was At-Rest when the message was transmitted.
8	Fix Confidence Bit.	1	Bit (7) 0=High confidence in GPS fix accuracy, 1=Reduced confidence in GPS fix accuracy.

Table 6 - Undesired Input State Message

Re-Center Message

The Re-Center message is transmitted when Reduced Messaging Mode is selected and the **SMART**ONE re-centers (automatically sets a new Change of Location Area). The subtype value of this message is 5. The message format is shown in table 7.

Byte Number	Variable	Bits	Description
0	Type field	2	Bit (1:0) = 0 = Standard message type:
0	Battery state	1	Bit (2) 0 = Good battery. 1 = replace battery.
0	GPS Data Valid	1	Bit (3) 0 = GPS Data valid in this message. 1 = GPS failed in this message cycle, ignore Latitude and Longitude fields.
0	Missed Input State Change	2	Bit (4) Missed Input 1. A value of 1 in this bit means that an input state change of Input 1 was missed due to the transmission of a higher priority message. Bit (5) = Missed Input 2. A value of 1 in this bit means that an input state change of Input 2 was missed due to the transmission of a higher priority message.
0	GPS fail counter	2	Bit (7:6) = GPS fail counter. Counts up to a maximum value of 3 upon GPS failure.
1,2,3,4,5,6	Latitude/Longitude	48	Byte 1 = Latitude MSByte Byte 2 = Latitude Byte 3 = Latitude LSByte

			Byte 4 = Longitude MSByte Byte 5 = Longitude Byte 6 = Longitude LSByte 360 degrees of Longitude coded in signed binary with 3 bytes and 180 degrees of Latitude coded in signed binary with 3 bytes. Positive Longitudes correspond to East Longitudes Positive Latitudes correspond to North Latitudes
7	Input Status	4	These bits reflect the state of the inputs and indicate which one, if any, triggered an Input Status Changed message. Bit 0: Input 1 change: 0 = Did not trigger message, 1 = Triggered message. Bit 1: Input 1 state: 0 = Closed, 1 = Open Bit 2: Input 2 change: 0 = Did not trigger message, 1 = Triggered message Bit 3: Input 2 state: 0 = Closed, 1 = Open
7	Standard Message Sub-Type	4	Bits (7:4) Standard message sub-type code. Value is 5 in the re-centering message.
8	RESERVED	3	Bits (2:0) RESERVED in SmartOne
8	Vibration triggered message	1	Bit (3) – Value 1 = This message is being sent because transmit on change of vibration state is selected and the vibration just changed state, or Undesired Vibration state is selected and the vibration is in the undesired state. Value 0 = This message is being transmitted for a reason other than the above reasons.
8	Vibration bit.	1	Bit (4) – Value 1 = Unit is in a state of vibration. Value 0 = Unit is not in a state of vibration.
8	2D	1	Bit (5) – Value 1 = GPS data reported is from a 2D fix. (Only 3 satellites were used in the fix.) Value 0 = GPS data reported is from a 3D fix.
8	Motion	1	Bit (6) – Value 1 = Device was In-Motion when the message was transmitted. Value 0 = Device was At-Rest when the message was transmitted.
8	Fix Confidence Bit.	1	Bit (7) 0=High confidence in GPS fix accuracy, 1=Reduced confidence in GPS fix accuracy.

Table 7 - Re-center Message

Type 1 Message Class

Truncated message type – Single Packet Version (Supported in firmware version 2.0 and later.)

This message type provides for up to 2 bytes plus 6 bits of user data to be appended to the status byte and GPS location information. The input and status bits data of the standard message are replaced with user data from the serial configuration port. The Truncated message will follow the following on-air format:

Variable	Bits	Description
Status Byte	8	Bit (1:0) = 1 = Truncated message type: Bit (7:2) = submask data from Truncated user data
Latitude/Longitude	48	Byte 1 = Latitude MSByte Byte 2 = Latitude Byte 3 = Latitude LSByte Byte 4 = Longitude MSByte Byte 5 = Longitude Byte 6 = Longitude LSByte 360 degrees of longitude coded in signed binary with 3 bytes and 180 degrees of latitude coded in signed binary with 3 bytes. Positive longitude correspond to East Longitudes Positive Latitude correspond to North Latitudes
User Data	16	Byte 1 = User data byte 1 Byte 2 = User data byte 2

Truncated message type – Multiple Packet Version (Supported in firmware version 2.1 and later.)

The Globalstar simplex messaging protocol provides for single and multiple packet messaging. In the event that the user application requests a user data length exceeding 9 bytes, the SmartOne (running firmware version 2.1 or later) will automatically "packetize" the message, that is, transmit it as multiple 9 byte packets. The ground station appliqué will reverse the process, "de-packetizing" the message back into a single ("long") message. From the user application point of view, this eliminates the 9 byte limitation allowing the user to compose longer messages transparently. They are presented to the user by the Globalstar back office as complete messages of a length longer than 9 bytes. The SmartOne supports user-defined messages (Class 1 and 2) of up to 54 bytes.

This message type provides for up to 47 bytes plus 6 bits of user data to be appended to the status byte and GPS location information. The input and status bits data of the standard message are replaced with user data from the serial configuration port. Note: Total message length will be a minimum of 9 bytes in length, and a maximum of 54 bytes

in length, and the length sent to the user will always be divisible by 9. The Truncated message will follow the following on-air format:

Variable	Bits	Description
Status Byte	8	Bit (1:0) = 1 = Truncated message type: Bit (7:2) = submask data from Truncated user data
Latitude/Longitude	48	Byte 1 = Latitude MSByte Byte 2 = Latitude Byte 3 = Latitude LSByte Byte 4 = Longitude MSByte Byte 5 = Longitude Byte 6 = Longitude LSByte 360 degrees of longitude coded in signed binary with 3 bytes and 180 degrees of latitude coded in signed binary with 3 bytes. Positive longitude correspond to East Longitudes Positive Latitude correspond to North Latitudes
User Data	variable	Byte 1 = User data byte 1 Byte 2 = User data byte 2 Byte 3 = User data byte 3 . . . Byte 47 = User data byte 47

Type 2 Message Class

Raw message type – Single Packet Version (Supported in firmware version 2.0 and later.)

Message type 2 shall be a Raw Payload message. This message type provides for up to 8 bytes plus 6 bits of user data. This mode is provided to enable the user to directly send a single data burst through the network. The only bits not accessible to the user are the message type bits needed by the receiving data processor to delineate message type associated to the TXID. User data less than the full payload will be zero padded as necessary. The Raw Payload message will follow the following on-air format:

Variable	Bits	Description
Status Byte	8	Bit (1:0) = 2 = Raw Payload message type: Bit (7:2) = submask data from Raw Payload user data
User Data	64	Byte 1 = User data byte 1 Byte 2 = User data byte 2 Byte 3 = User data byte 3 Byte 4 = User data byte 4 Byte 5 = User data byte 5 Byte 6 = User data byte 6 Byte 7 = User data byte 7 Byte 8 = User data byte 8

Raw message type – Multiple Packet Version (Supported in firmware version 2.1 and later.)

The Globalstar simplex messaging protocol provides for single and multiple packet messaging. In the event that the user application requests a user data length exceeding 9 bytes, the SmartOne (running firmware version 2.1 or later) will automatically "packetize" the message, that is, transmit it as multiple 9 byte packets. The ground station appliqué will reverse the process, "de-packetizing" the message back into a single ("long") message. From the user application point of view, this eliminates the 9 byte limitation allowing the user to compose longer messages transparently. They are presented to the user by the Globalstar back office as complete messages of a length longer than 9 bytes. The SmartOne supports user-defined messages (Class 1 and 2) of up to 54 bytes.

Message type 2 shall be a Raw Payload message. This message type provides for up to 53 bytes plus 6 bits of user data. This mode is provided to enable the user to directly send a single data burst through the network. The only bits not accessible to the user are the message type bits needed by the receiving data processor to delineate message type associated to the TXID. User data less than the full payload will be zero padded as necessary. Note: Total message length will be a minimum of 9 bytes in length, and a maximum of 54 bytes in length, and the length sent to the user will always be divisible by 9. The Raw Payload message will follow the following on-air format:

Variable	Bits	Description
Status Byte	8	Bit (1:0) = 2 = Raw Payload message type: Bit (7:2) = submask data from Raw Payload user data
User Data	variable	Byte 1 = User data byte 1 Byte 2 = User data byte 2 Byte 3 = User data byte 3 . . . Byte 53 = User data byte 53

Type 3 Message Class

The **SMART**ONE will use the Type 3 message class for the following message types:

Diagnostic Message – Subtype 21.
Replace Battery Message – Subtype 22.
Contact Service Provider Message – Subtype 23.

- Accumulate / Count Message – Subtype 24. Subtypes 0 – 3 are used by

earlier tracker products.

Diagnostic Message

The Diagnostic Message includes battery status, GPS average acquisition time, GPS fails and number of transmissions since the last Diagnostic Message.

The format and fields of the **SMART**ONE Diagnostic Message is shown in table 8 below.

Byte Number	Variable		Description
0	Type Field	2	Bit (1:0) = 3 Non Standard message type:
0	Subtype	6	Bit (7:2) = 21 for Diagnostic Message
1	Number of transmissions per burst.	4	Bits(3:0) = Number of Transmissions (1 to 15 Transmissions)
1	Battery Condition	1	Bit 4: 0 = Good battery. 1 = Replace Battery
1	GPS Subsystem Fault	1	Bit 5: 0 = GPS system OK. 1 = Fault
1	Transmitter Subsystem Fault	1	Bit 6: 0 = Transmitter OK. 1 = Fault.
1	Scheduler Subsystem Fault	1	Bit 7: 0 = OK. 1 = Fault
2	Min Interval	8	Minimum Interval between transmission attempts (5 second resolution) Default is 300 seconds
3	Max Interval	8	Maximum Interval between transmission attempts. Default is 600 seconds
4	GPS Mean Search Time	8	Unsigned binary count in seconds for mean GPS search to acquire
5,6	# GPS Fails	16	Unsigned binary count of failed GPS attempts since last Diagnostic Message
7,8	# Transmissions	16	# of transmissions since last Diagnostic message

Table 8 - Diagnostic Message

Replace Battery Message

The Replace Battery message has a format almost identical to the Diagnostic message. If enabled by the user, the Replace Battery message will be sent by the **SMART**ONE when the battery charge level is at or below the replace battery advisement level. The message will be repeated at an interval configurable by the user for as long as the battery remains below the advisement level. The default configuration is for the Replace Battery message to be enabled and to be transmitted

once per day when the battery is low. The format of the Replace Battery message is shown in table 9.

Byte Number	Variable	Bits	Description
0	Type Field	2	Bit (1:0) = 3 Non Standard message type:
0	Subtype	6	Bit (7:2) = 22 for Replace Battery Message.
1	Number of transmissions per burst.	4	Bits(3:0) = Number of Transmissions (1 to 15 Transmissions)
1	Battery Condition	1	Bit 4: 0 = Good battery. 1 = Replace Battery
1	GPS Subsystem Fault	1	Bit 5: 0 = GPS system OK. 1 = Fault
1	Transmitter Subsystem Fault	1	Bit 6: 0 = Transmitter OK. 1 = Fault.
1	Scheduler Subsystem Fault	1	Bit 7: 0 = OK. 1 = Fault
2	Min Interval	8	Minimum Interval between transmission attempts (5 second resolution) Default is 300 seconds
3	Max Interval	8	Maximum Interval between transmission attempts, Default is 600 seconds
4	GPS Mean Search Time	8	Unsigned binary count in seconds for mean GPS search to acquire
5,6	# GPS Fails	16	Unsigned binary count of failed GPS attempts since last Diagnostic message
7,8	# Transmissions	16	# of transmissions since last Diagnostic message

Table 9 - Replace Battery Message

Contact Service Provider Message

The **SMART**ONE will send a Contact Service Provider message when an internal fault is detected. The **SMART**ONE will send one such message upon the detection of an internal fault. It will then attempt to continue to operate normally. The **SMART**ONE will not send another Contact Service Provider message unless the fault is determined to have cleared, and then determined to have come back again. The Contact Service Provider message is shown in table 10.

Byte Number	Variable	Bits	Description
0	Type Field	2	Bit (1:0) = 3 Non Standard message type:
0	Subtype	6	Bit (7:2) = 23 Contact Service Provider Message
1	Number of transmissions	4	Bits(3:0) = Number of Transmissions (1 to 15

	per burst.		Transmissions)
1	Battery Condition	1	Bit 4: 0 = Good battery. 1 = Replace Battery
1	GPS Subsystem Fault	1	Bit 5: 0 = GPS system OK. 1 = Fault
1	Transmitter Subsystem Fault	1	Bit 6: 0 = Transmitter OK. 1 = Fault.
1	Scheduler Subsystem Fault	1	Bit 7: 0 = OK. 1 = Fault
2	Min Interval	8	Minimum Interval between transmission attempts (5 second resolution) Default is 300 seconds
3	Max Interval	8	Maximum Interval between transmission attempts, Default is 600 seconds
4	GPS Mean Search Time	8	Unsigned binary count in seconds for mean GPS search to acquire
5,6	# GPS Fails	16	Unsigned binary count of failed GPS attempts since last Diagnostic message
7,8	# Transmissions	16	# of transmissions since last Diagnostic message

Table 10 - Contact Service Provider Message

Accumulate/Count Message

The Accumulate/Count message is used to report the accumulation of time that an input is in a specified state as defined by the user, the accumulation of time that the device is in a State of Vibration, and/or the total transitions of the inputs as configured by the user. The message is transmitted either at a pre-set interval, at a point where any of the accumulation or count registers reach multiples as programmed by the user, just before rollover of any count/accumulate register, or all of the above. The format of the Accumulate/Count message is shown in table 11.

Byte Number	Variable	Bits	Description
0	Type Field	2	Bit (1:0) = 3 Non Standard message type:
0	Subtype	6	Bit (7:2) = 24 Accumulate/Count message.
1,2	Accumulate Input 1	16	Accumulated time that Input 1 has been in its undesired state with a resolution of 10 minutes. For example: 1 hour would be represented as a value of 6, 2 hours as a value of 12, etc. This resolution results in a rollover rate of a total time accumulation of approximately 1.25 years. (OxFFFF means that Input 1 Accumulate has been turned off)
3,4	Accumulate Input 2	16	Accumulated time that Input 2 has been in its undesired state with a resolution of 10 minutes. For example: 1 hour would be represented as a value of 6, 2 hours as a value of 12, etc. This resolution results in a rollover rate of a total time accumulation of approximately 1.25 years. (OxFFFF means that Input 1 Accumulate has been turned off)
5,6	Accumulate Vibration		Accumulated time that the **SMART**ONE has been in a State of Vibration with a resolution of 10 minutes. For example: 1 hour would be represented as a value of 6, 2 hours as a value of 12, etc. This resolution results in a rollover rate of a total time accumulation of approximately 1.25 years. (OxFFFF means that Input 1 Accumulate has been turned off)

7	Input 1 count	8	The total number of openings or closings of input 1 as selected by the user. (OxFF means that Input 1 Accumulate has been turned off)
8	Input 2 count	8	The total number of openings or closings of input 2 as selected by the user. (OxFF means that Input 1 Accumulate has been turned off)

Table 11 – Accumulate/Count Message

Messaging Priority

Prioritization of Periodic Standard Message Report Rates

The **SMART**ONE supports several rates at which it will send a periodic standard message. Periodic, scheduled standard message rates are mutually exclusive. This is the priority of the different rates at which the **SMART**ONE will send a standard message. Highest is listed first:

- Rate specified by Undesired Input State.
- Rate specified for when the **SMART**ONE is inside its Change of Location Area.
- Rate specified for when device is In Motion. (Note, when inside the Change of Location Area, this rate affects sampling, but not reporting, as indicated by a higher priority for inside Change of Location Area.)
- Rate specified for when the device is At Rest.

Message Priorities

It is possible that message types may collide. Whenever feasible, the **SMART**ONE will examine its known schedule and reschedule lower priority messages to occur after higher priority ones. If there is not enough time in the known schedule for all scheduled messages to be transmitted in a reasonable time, or there is insufficient memory to queue them, the lowest priority message(s) could be dropped. In any case, unscheduled messages (for example, Input Status Changed) shall cancel pending messages of lower priority and not cancel pending messages of higher priority. The following list shows the priority of message types, with the highest priority being listed first.

- Contact Service Provider
- User Defined Raw message. *
- User Defined Truncated message. *
- Change of Location Area
- Replace Battery
- Undesired Input State
- Re-Center
- Diagnostics
- Accumulate/Count
- Input Status Changed
- Device Turned On
- Normal Location (In-Motion or At-Rest).

* The two user defined message types actually have equal priority. Either one will cancel the other one. If, for example, the user interface commands the device to send a Truncated message, and then, before it has time to obtain a fix and send the message, the user commands a Raw message, the raw will be sent.

Serial Commands

The SMARTONE uses the I/O port for unit configuration as well as interface to remote passive and smart sensors. Two commands are provided in the unit interface to support smart sensors. External sensors that can format and communicate to the SMARTONE can send user data through the SMARTONE by using these two commands.

> This section describes the serial interface between the SMARTONE and a computer or other programming device. SMARTONE will respond to any command that contains fields with invalid values with a NAK response (command field set to 0xFF).

Serial Packet Format (commands and answers)

Communication to the **SMART**ONE will follow the following specific format:

Preamble 1 byte	Length 1 byte	Cmd 1 byte	Data Variable length 0 – 54 bytes	CRC 2 byte

Total length range permitted: 5 bytes (Data field length 0) to 59 bytes (Data field length 54).

Serial Packet Format

The different fields are defined as:

Serial Packet Fields

Preamble	Fixed pattern 0xAA
Length	Total number of bytes in the serial packet including the preamble
Cmd	Command type (See table below). Responses to commands carry the same command type as the command that initiated the answer
Data	Data associated with the command or answer
CRC low	Least significant byte of the 16-bit CRC
CRC high	Most significant byte of the 16-bit CRC

CRC Algorithm

The Security Field is a 16-bit CRC of all of the previous fields including the preamble, length, and command bytes. The remainder is initialized to all 1's (0xFFFF) and the CRC is inverted before being sent. Following is a sample C routine that implements the algorithm using the "reversed" technique:

```
WORD crc16_lsb(BYTE *pData, WORD length)
 {
    BYTE i;
    WORD data, crc;
    crc = 0xFFFF;
    if (length == 0)
       return 0;
    do
       {
          data = (WORD)0x00FF & *pData++;
          crc = crc ^ data;
          for (i = 8; i > 0; i--)
             {
                if (crc & 0x0001)
                   crc = (crc >> 1) ^ 0x8408;
                else
                   crc >>= 1;
             }
       }
    while (--length);
    crc = ~crc;
    return (crc);
 }
```

As an example, for a type (0x01) “Get ID” message made up of the following bytes:

AA 05 01

The following 2 byte CRC would be calculated:

D5 50

The complete message sent by the host to the **SMART**ONE is:

AA 05 01 50 D5

Serial Packet Types

Cmd	Description / Usage / Comment	Command Data Bytes	Acknowledge Data Bytes
0x01	User requests the **SMART**ONE to reply with integral ESN (Electronic Serial Number). This is the ID used by Globalstar to identify the unit.	None	Four data bytes, which contain the unit ID as an unsigned integer. The MSByte is sent first. Only the 27 LSbits are non-zero.
0x26	Send Truncated message.	See Truncated Message section below	None
0x27	Send Raw Message	See Raw Message Section below	None

Send Truncated Message (serial message type 0x26)

The **SMART**ONE will perform a GPS location and append user data passed to the unit via the Truncated Message command 0x26.

Two bytes plus 6 bits of user data may be sent with the standard GPS location information in a messaging burst. Two bits are set in the on-air message by the SmartOne informing the recipient that the message is the Truncated type.

The following table defines the message structure of the "data" portion of the command used to send a Truncated message.

Truncated Serial Message

Byte	Bit	Parameter	Description	Default Value
0	7:2	Submask Bits	User data bits. Bits 1:0 are reserved and will be masked by SmartOne.	0x00
Variable.		User Data	Any user data Firmware version 2.0 supports a maximum of 2 total bytes of data in this field. Version 2.1 and higher supports a maximum of 47 total bytes in this field. User application (smart sensor) should transmit only as many bytes as needed (don't "pad" the message) in order to keep on air packets to a minimum.	

Example of sending a "Truncated" user message

The host sends:

AA 08 26 10 22 33 <CRC-low> <CRC-High>

The SmartOne would respond:

AA 05 26 <CRC-Low> <CRC-High>

What would go out over the air is:

11 Lat-3 Lat-2 Lat-1 Lon-3 Lon-2 Lon-1 22 33

Another example, using a longer message as supported by firmware version 2.1 and higher:

The host sends:

AA 0D 26 10 22 33 44 55 66 77 88 <CRC-low> <CRC-High>

Note the length field: 0D – 0D is the number 13 in hexadecimal, the length of the total serial command.

The SmartOne would respond:

AA 05 26 <CRC-Low> <CRC-High>

What would go out over the air is:

11 Lat-3 Lat-2 Lat-1 Lon-3 Lon-2 Lon-1 22 33 44 55 66 77 88 00 00 00 00

Note that all on air messages are padded to a multiple of 9 bytes. This is the reason for the trailing zeros in this example.

Note that the least two significant bits of the first byte are always "01" for a trunc message, the remaining 6 bits make up the top 6 bits of the first byte sent in the serial command, in this example 000100xx (with the "xx" representing the two bits that the SmartOne forces to "01".

The 22 and the 33 that the user sent are appended after the 6 bytes of latitude and longitude.

Send Raw Message (serial message type 0x27)

The **SMART**ONE will send raw user data using the Raw Payload command 0x27.

8 bytes plus 6 bits of user data may be sent. Two bits are set in the on-air message by the SmartOne informing the recipient that the message is Raw.

The following table defines the message structure used to send a Raw message.

Raw Payload Serial Message

Byte	Bit	Parameter	Description	Default Value
0	7:2	Submask Bits	User data bits. Bits 1:0 are reserved and will be masked by SmartOne.	0x00
Variable		User Data	Any user data Firmware version 2.0 supports a maximum of 8 total bytes of data in this field. Version 2.1 and higher supports a maximum of 53 total bytes in this field. User application (smart sensor) should transmit only as many bytes as needed (don't "pad" the message) in order to keep on air packets to a minimum.	

Example of sending a "raw" user message:

She Host sends:

AA 0E 27 10 22 33 44 55 66 77 88 99 <CRC-low> <CRC-high>

The SmartOne Responds:

AA 05 27 <CRC-low> <CRC-high>

What actually goes out over the air is:

12 22 33 44 55 66 77 88 99

Another example, using a longer message as supported by firmware version 2.1 and higher:

The Host sends:

AA 21 27 10 22 33 44 55 66 77 88 99 AA BB CC DD EE FF 11 22 33 44 55 66 77 88 99 AA 44 56 78 <CRC-low> <CRC-high>

Note the length field, the command contains a total of 33 bytes. The length is 21 Hexadecimal, which is equal to 33 decimal.

The SmartOne Responds:

AA 05 27 <CRC-low> <CRC-high>

What actually goes out over the air is:

12 22 33 44 55 66 77 88 99 AA BB CC DD EE FF 11 22 33 44 55 66 77 88 99 AA 44 56 78 00 00 00 00 00 00 00 00

Note that all on air messages are padded to a multiple of 9 bytes. This is the reason for the trailing zeros in this example.

Note that the least two significant bits of the first byte are always “10” for a raw message (a HEX or decimal value of “2”, the remaining 6 bits make up the top 6 bits of the first byte sent in the serial command, in this example 000100xx (with the “xx” representing the two bits that the SmartOne forces to “10”.

A simple ACK or NAK from the SMARTONE Device to the host (smart sensor):
ACKs:

AA 05 26 <crc crc> (for the Truncated message)

AA 05 27 <crc crc> (for the Raw message)

NAK:

AA 05 FF <crc crc> (NAK).

Notes:

As the SmartOne operates, some debugging traces come out of the serial port. Those traces should simply be ignored. Once the handshake line is pulled low, the unit is in “command mode” and debugging traces will stop.

User commands will ALWAYS be responded to immediately with either an acknowledgement or a NAK (as shown in the examples above). Once an acknowledgement (or NAK) is received, the host should simply ignore the serial port until the next time it sends a command.

The most common reasons for a NAK are incorrect CRC, incorrect length field, or incorrect command field (i.e. not 0x26 or 0x27 for trunc and raw respectively).

The Handshake Line

The handshake line should be pulled low before sending each serial message. The recommended use of the handshake line is:
Pull handshake low.
Wait 2 – 3 milliseconds.
Send command
Receive response.
Raise handshake high.

Connecting Serial Devices to the SMARTONE

The **SMART**ONE accepts a serial connection at 3.3 volt levels (Max), at 9600 baud. The relevant pins are TX, RX, Handshake and ground. The **SMART**ONE can connect with devices that contain an asynchronous UART at 3.3 volt levels. (High State: 2.7-3.3 Volts, Low State: 0 Volts. **Please contact Globalstar Support for more information.**

CAUTION: NEVER attempt to connect the SMARTONE directly to the pins on a computer's RS232 port. The voltages in RS232 are too high and can damage the SMARTONE.

Any deviations from the above guidelines will violate all RMA requirements and prevent any no-cost replacement.

See Appendix K for information on the Serial Input Cable for the SMARTONE

Glossary of Terms

Accumulate Hours – The activity time accumulated in the Inputs of the device while the Input is in the user defined state.

Activation – The activation of an ESN (electronic serial number) on the Globalstar satellite network. The process consists of programming a start and an end date for the use of the ESN and the payment of certain fees to Globalstar. Sometimes referred to as "provisioning."

At Rest – a tracker is considered to be at rest when the comparison of a new GPS reading to a previous GPS reading indicates that the tracker has not changed location by more than a specified minimum distance. The specified minimum time and the specified minimum distance are both configuration parameters.

C

Configuration – the collection of variables that control the operating performance of a tracker. Sometimes referred to as the "configuration."

Configure (configuring) – Programming (setting) the variables that control the operation performance of a tracker.

Count Events – The accumulated number of state changes in the Inputs of the device.

D

Delay To Start – Specific delay in time following the programming of the device to commence operation.

Desired State – The state of the Input in normal condition defined by the user.

E

ESN – Electronic Serial Number is a unique number assigned to each SMARTONE device. The ESN is used by the Globalstar Simplex Network to identify messages from the devices o the field.

F

Failed GPS reading – A GPS reading could not be processed from available GPS satellite signals.

FW Ver – Firmware version is the existing software loaded in the device main processor

G

GPS – The GPS (Global Positioning System) is a "constellation" of 24

well-spaced satellites that orbit the Earth and make it possible for people with ground receivers to pinpoint their geographic location.

GPS reading – The longitude, latitude, time, and date information obtained from processing the signals from the GPS satellites.

I

In Motion – The unit is considered to be In Motion when there is a State of Vibration – and – when a comparison of a new GPS reading to a previous GPS reading indicates the tracker has changed location by at least a specified minimum distance. The specified minimum time and the specified minimum distance are both configuration parameters.

Inaccurate GPS reading – The longitude and latitude information obtained from processing the signals from the GPS satellites when a tracker can not observe an adequate number of satellites; the GPS signals were jammed by electronic interference; the GPS signals were reflected from objects creating multi-path conditions; or weather conditions distorted the GPS signals. An inaccurate GPS reading may have longitude and latitude errors of a mile or more.

Input – A digital channel in the device that allows the detection of switch stage changes. The inputs are dry contact inputs, ON/OFF.

Level of Sensitivity for Vibration Sensor – a configurable parameter that sets the number of pulses per minute that a vibration sensor must detect to be considered sensing vibration.

M

Message – A collection of information that is transmitted in a group over the satellite network.

Message Interval – The amount of time specified by the user between Location Messages. The SMARTONE transmits a Location Message once the Message Interval has elapsed. The internal clock on the device is reset to the interval time after each transmission. The SMARTONE is in low power consumption Mode during the interval to preserve battery life.

Message Time(s) of Day – The specific time of day in military format for the SMARTONE to transmit Location Messages. . The SMARTONE is in low power consumption Mode between the specific times of day to preserve battery life.

Message Transmission – The process of sending a message over the satellite network. The process includes sending a message multiple times to improve the transmission success rate.

N

Number of message repeats – The number of times a message is send in a

message transmission with the same UMN. The number of message repeats is configurable during the tracker set up process. Globalstar only counts repeated messages as one message if it is received three times or less. If the same message is receive more than three times Globalstar may count the message as more than one message for billing purposes

S

Self Test – An internal unit test that is performed by the processor. The test checks for proper operation of functions that can be tested by the processor.

State of lacking Vibration – The vibration sensor is indicating a cease of vibration when the number of vibration pulses per minute is lower than the Level of Sensitivity for Vibration Sensor number for the time required to determine if a State of Vibration has ceased.

State of Vibration – The vibration sensor is in a State of Vibration when the number of vibration pulses per minute exceeds the Level of Sensitivity for Vibration Sensor for the time required to detect a State of Vibration.

T

Time to be in a State of Lacking Vibration– a configurable parameter that sets the period of time vibration has to be absent to determine if a State of Vibration has ceased.

Time to be in a State of Vibration – a configurable parameter that sets the period of time used to determine if a State of Vibration exists.

U

Undesired State Message – The SMARTONE sends this message at a user defined interval while any of its Inputs are in the closed or opened state depending on the user selection

Appendix A: Technical Support

For technical support please contact Globalstar, Inc. corporate headquarters at: 1.877.452.5782 or 1.905.712.7197 or by email: **customerservice@globalstar.com**.

Appendix B: RF Radiation Exposure Statement

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. End users must follow the specific operating instructions for satisfying RF exposure compliance. The antenna(s) used for this transmitter must be installed to provide a separation distance of at least 20 cm from all persons and must not be co-located or operating in conjunction with any other antenna or transmitter.

RAPPORT D'EXPOSITION DE RAYONNEMENT DE LA FCC RF Cet equipment est conforme aux limites d'exposition de rayonnement de la FCC RF determinees pour un environnement non controle. Cet equipment devrait etre installe et actionne avec une distance minimum de 20 cm entre le radiature et votre corps.

Appendix C: Regulatory Notices

FCC/IC Notices

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation. This device complies with the requirements for radio astronomy site avoidance as specified by the Globalstar National Science Foundation agreement of 2001. It is compliant with CFR 25.213.

This Class B digital apparatus complies with Canadian ICES-003.

This device automatically adjusts its transmission frequency according to its location and is compliant with international regulatory requirements.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

NOTE: The manufacturer is not responsible for any radio or TV interference caused by unauthorized modifications to this equipment. Such modifications could void the user's authority to operate the equipment.

The device and technology herein is protected under U.S. Patent numbers 6,317,029; 6,396,819; 7,337,061; 7,672,639 & patents pending.

Battery Caution Statement per IEC/EN60960-1 1.7.13 Caution! Risk of explosion if battery is replaced by an incorrect type. Dispose of used batteries according to the instructions.

FCC/IC Notice

Cet équipement a été examiné et s'est avéré conforme aux limites pour un dispositif numérique de la classe B, conformément à la partie 15 des règles de FCC. L'opération est sujette aux deux conditions suivantes : (1) ce dispositif ne doit pas causer d'interférence nocive, et (2) ce dispositif doit accepter n'importe quelle interférence reçue, y compris l'interférence qui peut causer une opération peu désirée. Ce dispositif est conforme aux conditions d'éviter les sites d'emplacement de radio-astronomie comme spécifique par l'accord Foundation National des Sciences de Globalstar de 2001. Il est conforme avec CFR 25.213. Ce dispositif s'ajuste automatiquement sur la fréquence de transmission selon son endroit et est conforme avec des conditions de normalisation internationales.

Cet appareillage numérique de la classe B est conforme à ICES-003 d'Industrie Canada.

ATTENTIONS ET AVERTISSEMENTS

Tous les changements ou modifications pas expressément approuvés par la garantie de ce dispositif peuvent empêcher ou annuler l'utilisateur d'opérer cet équipement.

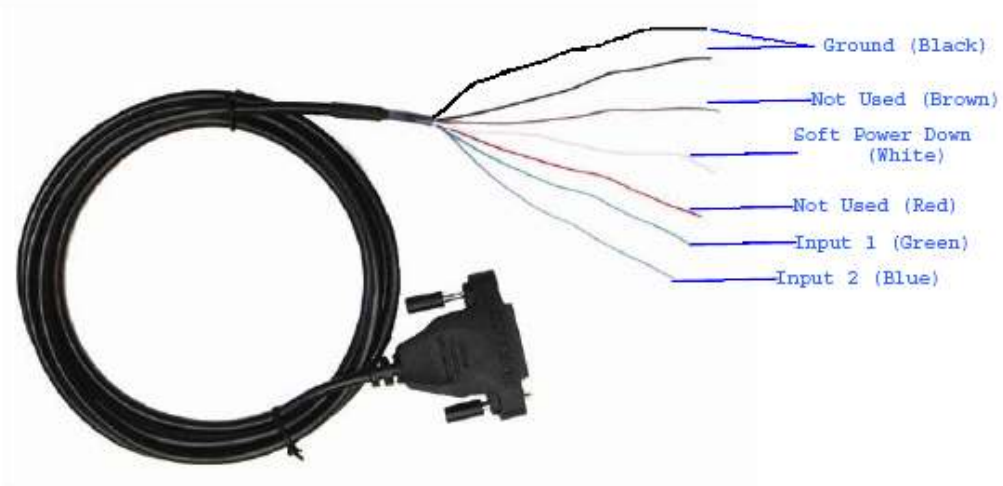
Danger d'explosion si la batterie est inexactement remplacée. Remplacez seulement par la même batterie ou le type équivalent recommandé. Débarrassez-vous des batteries utilisées selon les instructions du fabricant.

Appendix D: Environmental Specifications

- -30 degrees C to +60 degrees C operating temperature range. The device shall remain operational over the -40 to +80 degrees C range though may experience battery life and RF signal degradation.
- IP67 (Intrusion Protection)
- IP68 (Freeze-Thaw)
- IP69K (High Pressure Washing)
- MIL-STD-810F (95% to 100% Condensing) (Humidity)
- MIL-STD 810E Method 509.3 5% NaCl, 95% Distilled Water (Salt Fog)
- SAE J1455 (Random 20 Hz to 2000 Hz, 0.40 g2/hz, One Hour Per Axis) (Vibration)
- SAE J1455 (Thermal Shock Test)
- SAE J1455 (Thermal Shock Test Performed Under 2 Inches Of Water)
- Intrinsically Safe to Class 1, Division 1, Group A-D Standards. Only used batteries- not when used with line power.(United States UL913 & Canada CSA C22.2 No. 157)

Appendix E: Accessories

SMARTONE Old External Inputs Cable - Part #2030-0263-01 (Discontinued)



SMARTONE USB Configuration Cable – Part #2030-0261-01

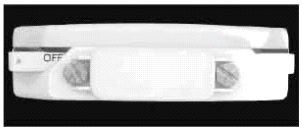
Appendix F: Battery Installation Guide

SMARTONE
SATELLITE MANAGED ASSET READY TRACKER

Battery Installation Guide

Step 1

Make sure connector cover is in the "OFF" position and screwed in place. If so, proceed to Step 4.



Step 2

Find the jumper on the back of the connector cover and align the connector cover with the **SMART**ONE so it is in the "OFF" Position.

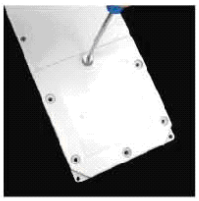
Step 3

Make sure the jumper covers the 6th set of pins from the left and gently push the cap on until it is flush with the unit. Be sure to screw the connector cover in place to insure the jumper is completely engaged.

Step 4

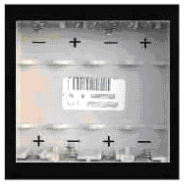
Unscrew the six flat-head screws on the Battery Compartment Cover.

Note: New units are shipped with the mounting bracket screws stored in the battery compartment. Please remove screws before installing batteries.



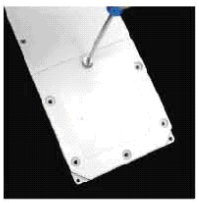
Step 5

Remove the cover and add or replace batteries. Make sure to use Lithium AA batteries and insert them as instructed on the battery Compartment. Make sure the black gasket surrounding the Battery Compartment lays flat in it's groove before replacing the Battery Compartment Cover.



Step 6

Replace the cover and screw all 6 flat-head screws. **DO NOT OVERTIGHTEN SCREWS.** Tighten to 36 In-Oz (Torque Setting).



Appendix G: Latitude/Longitude Decoding

Example Message = 0x002B5372BFF12F0A02

	0x 00	2B	53	72	BF	F1	2F	0A 02
Signed integer (MSB..LSB)		Lat2	Lat1	Lat0	Long2	Long1	Long0	

Calculating Latitude

Negative Latitude corresponds to Latitude in the SOUTHERN Hemisphere.
Positive Latitude corresponds to Latitude in the NORTHERN Hemisphere.

Degree_per_count_lat =$(90.0/2^{23})$

Hex Lat = 0X2B5372 ; Conversion to Decimal = 2,839,410

Latitude = Decimal Lat bytes * Degree_per_count_lat
= 2,839,410 * $(90.0/2^{23})$
= 30.463564 degrees NORTH

Note: If greater than 90 degrees, 180 must be subtracted from result

Calculating Longitude

Negative Longitude corresponds to Longitude in the WESTERN Hemisphere.
Positive Longitude corresponds to Longitude in the EASTERN Hemisphere.

Degree_per_count_long =$(180.0/2^{23})$

Hex Long = 0XBFF12F ; Conversion to Decimal = 12,579,119

Longitude = Decimal Long bytes * Degree_per_count_long
= 12,579,119 * $(180.0/2^{23})$
= 269.918611

Note: If greater than 180 degrees, 360 must be subtracted from result.Therefore, **269.918611 degrees – 360 degrees**
= -90.081388 degrees
= 90.081388 degrees WEST

Appendix H: Standard Message Decoding

Message Example = 0xC02B5387BFF129090C

0x C0 2B 53 87 BF F1 29 09 0C

Byte 0 1 2 3 4 5 6 7 8

Latitude Longitude

Byte 0 = C 0
Binary = 1100 0000 (7:0)

Bit (1:0) = 0 Standard message type
Bit (2) = 0 Good battery
Bit (3) = 0 GPS Data valid
Bit (4) = 0 No missed event on Input 1
Bit (5) = 0 No missed event on Input 2
Bit (7:6) = 3 GPS fail counter.

Byte 7 = 0 9
Binary = 0000 1001 (7:0)

Input Status (3:0)

Bit (0) = 1 Input 1 change triggered message
Bit (1) = 0 Input 1 state Closed
Bit (2) = 0 Input 2 change did not trigger message
Bit (3) = 1 Input 2 state Open

Subtype (7:4)
Bits (7:4) = 0 for location message sub-type

Byte 8 = 0 C
Binary = 0000 1100 (7:0)

Bits (2:0) = Reserved in the SMARTONE Device
Bit (3) = 1 Vibration triggered message
Bit (4) = 0 Unit is not in a state of vibration
Bit (5) = 0 GPS data reported is from a 3D fix.
Bit (6) = 0 Device was At Rest when the message was transmitted
Bit (7) = 0 High confidence in GPS fix accuracy

Note: The following 5 messages have the same message format as the Location Message. The only difference is the sub-type value of Byte 7.

Sub-type Value	Message
=1	Device Turned On
=2	Change of Location alert
=3	Input Status Changed
=4	Undesired Input State
=5	Re-center

Appendix I: Diagnostic Message Decoding

Message Example = 0x 57033C784F00000009

	0x	57	03	3C	78	4F	00	00	00	09
Byte	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	

Byte 0 = 5 7
Binary = 0101 0111 (7:0)
Bits (1:0) = 3 Non Standard message type
Bits (7:2) = 21 for Diagnostic Message

Byte 1 = 0 3
Binary = 0000 0011 (7:0)
Bits(3:0) = 3 Number of Transmissions
Bit (4) = 0 Good battery
Bit (5) = 0 GPS system OK
Bit (6) = 0 Transmitter OK
Bit (7) = 0 Scheduler Subsystem OK

Byte 2 = 3 C
Decimal = 60
Minimum Interval between transmission attempts
(5 second resolution, 300)

Byte 3 = 7 8
Decimal = 120
Maximum Interval between transmission attempts.
(5 second resolution, 600)

Byte 4 = 4 F
Decimal = 79
Unsigned binary count in seconds for mean GPS search to acquire

Byte 5 & 6 = 00 00
Decimal = 0
Unsigned binary count of failed GPS attempts since last Diagnostic Message

Byte 7 & 8 = 00 09
Decimal = 9
# of transmissions since last Diagnostic message

Note: The following 2 messages have the same message format as the Diagnostic Message. The only difference is the value of Bits(7:2) of Byte 0

Bits (7:2) Value	Message
=22	Replace Battery
=23	Contact Service Provider

Appendix J: Accumulate/Count Message Decoding

Message Example = 0x63FFFFFFFFFFF7DFF

	0x	63	FF	FF	FF	FF	FF	FF	7D	FF
Byte	0	1	2	3	4	5	6	7	8	

Byte 0 = 6 3
Binary = 0110 0011 (7:0)
Bits (1:0) = 3 Non Standard message type
Bits (7:2) = 24 for Accumulate/Count Message

Byte 1 & 2 = FFFF
Accumulated time that Input 1 has been in its undesired state with a resolution of 10 minutes.
OxFFFF means that Input 1 Accumulate has been turned off

Byte 3 & 4 = FFFF
OxFFFF means that Input 2 Accumulate has been turned off

Byte 5 & 6 = FFFF
Accumulated time that the SMARTONE has been in a State of Vibration with a resolution of 10 minutes.
OxFFFF means that accumulate time of vibration been turned off

Byte 7 = 7D
Decimal = 125
The total number of openings or closings of Input 1

Byte 8 = FF
OxFF means that Input 2 Accumulate count has been turned off

Appendix K: Serial Input Cable

INSTRUCTIONS AND WIRING DIAGRAM FOR SERIAL INPUT CABLE (PN# 2030-0265-04)

INSTRUCTIONS

1. This cable is designed to work with the SmartOne B only. Do not use with the SmartOne A
2. This cable is designed to work with 3 V logic only. Do not use with 5 V logic devices.
3. Be certain that unused wires do not short to each other.
4. All ground wires are common; Therefore, any ground can be used with any function.

Connector

Pin #	COLOR	FUNCTION
3	BROWN	SETUP (HANDSHAKE FROM SERIAL DEVICE)
4	RED	RX (TX FROM SERIAL DEVICE)
5	ORANGE	TX (TO SERIAL DEVICE rx)
11	YELLOW	SOFT POWER DOWN (NORMALLY OPEN)
2	GREEN	GROUND
12	BLUE	GROUND
19*	VIOLET	LINE POWER +
20*	GRAY	LINE POWER –
9	WHITE	DRY CONTACT 1
2	BLACK	GROUND
8	LIGHT BLUE	DRY CONTACT 2
12	PINK	GROUND

*** Use with SmartOne LP version only. For line power operation, connect 10 to 48 volts DC to these wires.**

Appendix L: External Input Cable (Discontinued)

INSTRUCTIONS AND WIRING DIAGRAM FOR EXTERNAL INPUT CABLE (PN# 2030-0265-02)

INSTRUCTIONS

1. This cable is designed to work with the SmartOne B only. Do not use with the SmartOne A
2. Be certain that unused wires do not short to each other.
3. All ground wires are common; therefore any ground can be used with any function.

WIRING DIAGRAM

Connector Pin #	COLOR	FUNCTION
11	YELLOW	SOFT POWER DOWN (NORMALLY OPEN)
2	GREEN	GROUND
12	BLUE	GROUND
19*	VIOLET	LINE POWER +
20*	GRAY	LINE POWER –
9	WHITE	DRY CONTACT 1
2	BLACK	GROUND
8	LIGHT BLUE	DRY CONTACT 2
12	PINK	GROUND

*** Use with SmartOne LP version only. For line power operation, connect 10 to 48 volts DC to these wires.**